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Page 166



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Executive Vice-President

RICHARD E. DEEMS

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Managing Editor

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Shop Notes and Crafts Editor

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Radio-Television, Electronics Editor

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Room 4102, Empire State Bldg.,
New York City 1

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Suite 1003, 3400 Wilshire Blvd.
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Next Month...

THE GREATEST—and shortest—mass migration of all time soon will take place. Millions of persons will move from inside their homes to lawns, patios and swimming pools. In April we present our annual Outdoor Living Section. You'll find plans for an outdoor living wall (complete with sink, built-in storage and even TV), information on covered patios and swimming pools. . . . Also in April, the owners drive the Falcon 1,400,000 miles—and give their report

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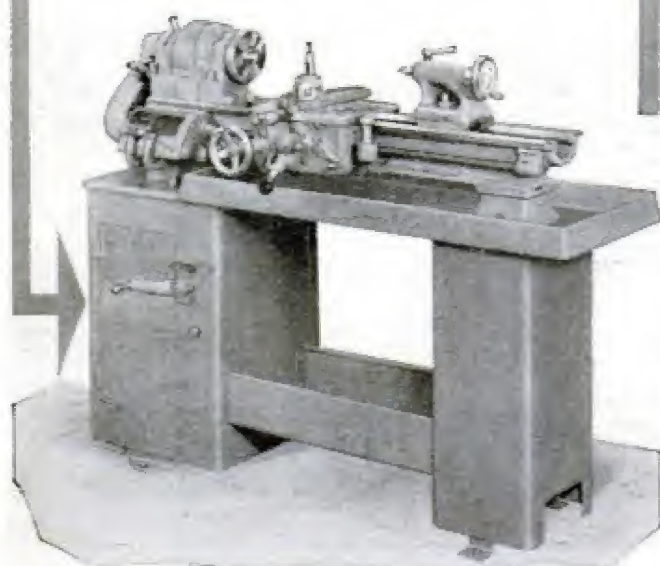
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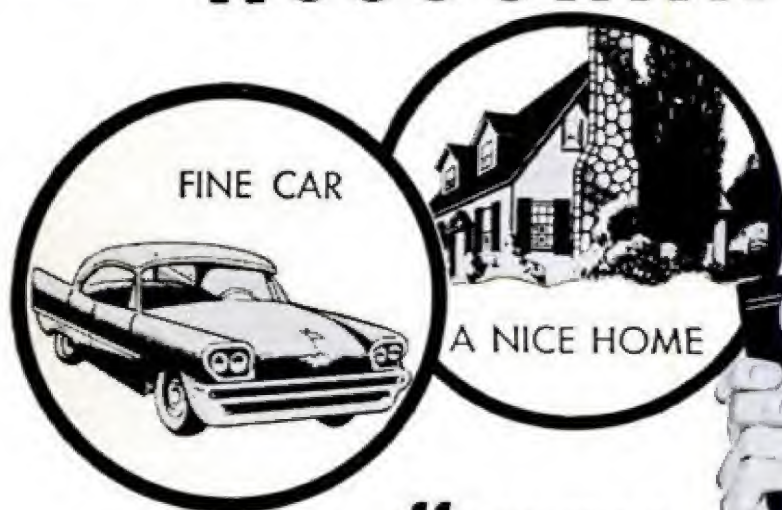
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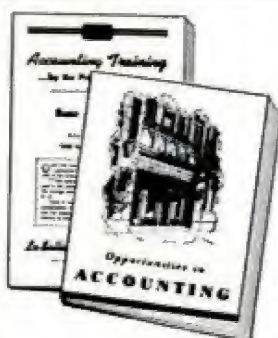
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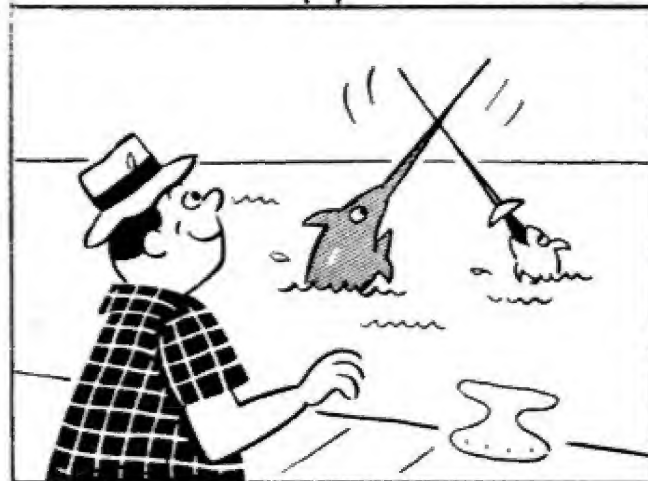
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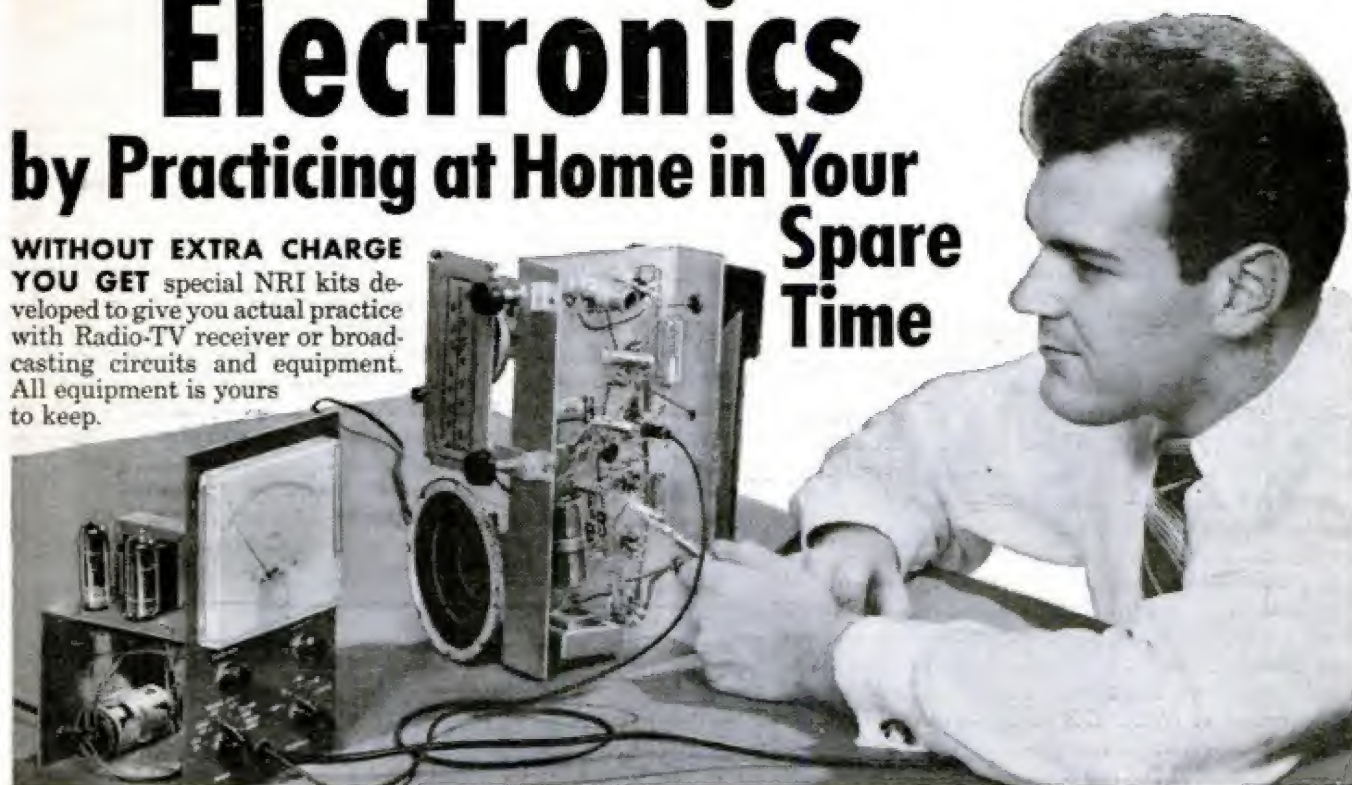
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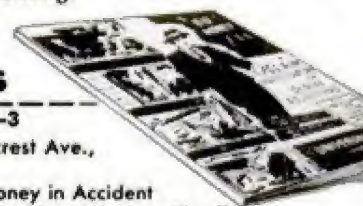
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Sidelights from the PENTAGON

By William R. Kreh

When men of the Navy's Experimental Air Squadron 6 return from this year's expedition in the Antarctic, they may seem a little buggy.

But don't blame it all on the six months of isolated duty at the South Pole.

They've been contributing to the advancement of scientific knowledge—by collecting bugs, no less.

The icy insects were needed by entomologists on Operation Deepfreeze 60 who wanted to see just what kind of bugs would live in the icy wastes. It's believed that the insects aren't there by their own choices; that they're blown there on winds from South America.

So it's reported that everywhere you look around the Navy camp at McMurdo base are brightly colored butterfly-like nets. And the Navy men devised two net sleeves on a specially constructed hoist that swings them out of the doors of one of their single-engine planes. At least three times a week, the flight schedule lists a three-hour "bug run."

The Army's trying to come up with a dual-purpose carton for combat-type meals.

The idea is to find a carton that can be used as a package and later converted to a stove. One example would be a box which, when emptied, would make a stove with legs. Water could be added to the bottom of the box, a fuel table set underneath, food on top, and presto—one short order coming up.

The Air Force is testing a remotely controlled "decontamination sweeper" designed to keep bases operating in case of a radioactive fallout.

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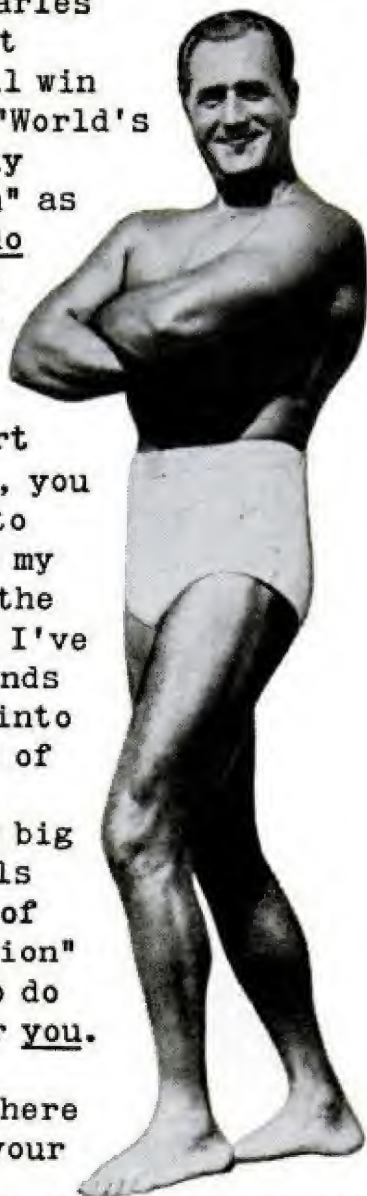
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—By James S. Thistle—

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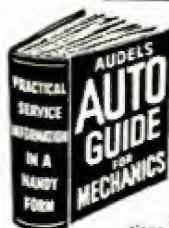
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Over the Editor's Desk



IN ROHNER PARK at Fortuna, Calif., stands this monument to a beetle.

The hero of this unusual honor is the Klamath Weed Beetle, acclaimed for its part in ridding California of the Klamath weed (*Hypericum perforatum*), sometimes known as goatweed. An immigrant from



Europe, the weed by 1940 had overrun 250,000 acres of 27 California counties, depreciating land values and irritating cattle and sheep grazing on it. The beetle was imported from Australia in 1945-46 and went to work against the weed.

For the story of this and other battles of man and nature, turn to the article "Should We Let Nature Take Its Course," beginning on page 106.

☆☆☆

To the Editor:

I certainly enjoyed your automotive section in the January issue of PM.

Several of our library people were wondering if it would be possible to get a copy of the pull-out insert which starts on Page 145. They feel it is a good graphic history of the auto industry. Three copies would fill our needs if extras are available.

Fred A. Chapman,
Automobile Manufacturers Association,
Detroit, Mich.

☆☆☆

Ready-to-Frame Reprints Available

We still have a supply of the full-color pictorial history of "The American Automobile" which was originally published in our January auto issue. These colorful and informative reprints are 31 inches long, 10 inches high and printed on one side only. They will be mailed to you unfolded and ready for framing upon receipt of 25 cents

(Continued to page 20)

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World's Highest Tower

Henry Whiting of Auburn, Me., takes issue with our description of Tokyo's new television tower as the "world's highest tower." The report appeared on page 128 of the January issue. The folks in Maine, he says, claim as the world's highest the television tower of station WGAN, on Brown Hill 25 miles from Portland—1619 feet high, compared with Tokyo tower's 1092 feet.

☆☆☆

Another World's Highest

You state that the Tokyo TV tower is the highest TV tower in the world. Please check your measurements again and you will find that the Tokyo Tower including the TV antenna is 518 feet shorter than KSWB TV in Roswell, N. Mex., which is 1610 feet above the ground plus 3600 feet above sea level so I guess we beat them pretty good.

Everett Griffin
Roswell, N.Mex.

☆☆☆

Homemade Golf Cart

There is an old saying that when a man gets too old to fish he starts playing golf. But what does a man do when he gets too old to walk around the golf course?

Most men would be content to settle down in the old rockin' chair, but not Adolph Birr. Adolph, who likes to make things almost as much as he likes to play golf, decided to make his own power golf cart. Adolph, 64, plans to retire in March. He is a powerhouse operator in the Niagara, Wis., mill of Kimberly-Clark Corporation, which manufactures paper products.



He started with a sheet of ½-inch plywood, reinforced it at strategic places, added two 16-inch wheelbarrow wheels and tires on the rear and a 20-inch bicycle wheel in front. It was necessary that the front

(Continued to page 22)

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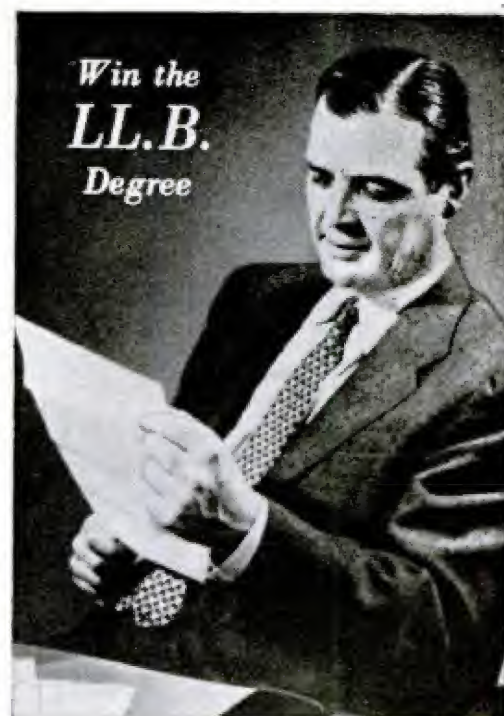
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CASE #1 Jones wrote Smith making an offer. Smith wrote his acceptance and mailed it. Then he decided to call it off and telegraphed Jones to that effect. Jones got the telegram before he did the letter. May he hold Smith to the contract?

ANSWER. Yes. Both Smith and Jones became bound when the letter containing the acceptance was mailed.

CASE #2 Doe said to Crane, "I will sell you 100 shares of XY stock at \$50." Crane said, "I'll give you \$45." Doe, knowing the market was unsettled, said nothing, but an hour later tendered 100 shares and a bill for \$4,500. May he hold Crane?

ANSWER: No. Crane's counter-offer was a rejection of Doe's offer.



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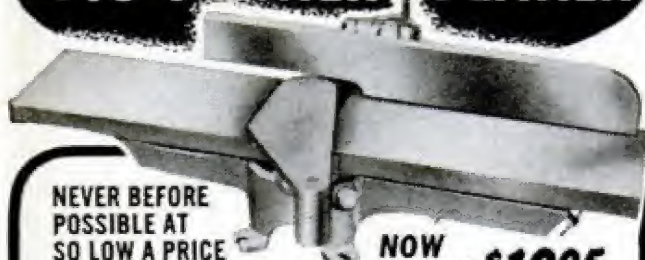
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wheel and accompanying fork be very substantial so Adolph looked around a long time before he found a wheel with heavy-duty spokes and a solid steel fork.

He purchased a new Briggs and Stratton three-horsepower gasoline engine and installed it with the necessary drive mechanism. Then he enclosed everything with 1/8-inch Masonite board. He trimmed the edges with chrome strips and painted the cart yellow with black trim. He made the seat cushion from upholstery springs and foam rubber and covered it with an exotic scarlet material.

While he was building the cart, Adolph kept in mind many important details. For example, the cart had to fit into his station wagon and be easily loaded and unloaded. It had to have a compartment for beer and ice, a hitch and chain for pulling stumps and trees which created unplayable lies and an umbrella to protect him from the rain.

For loading the cart, Adolph built a grooved ramp and a device to lock the front wheel of the cart in position so it can be rolled into the wagon easily.



The controls are extremely simple. There is a starter, accelerator, brake lever and shut-off switch. The engine drives the rear wheels through a centrifugal clutch so there are no gears to shift. Adolph used some unusual parts for his cart, but the most unique application of all is the hinge on the steering rod. It is a knee joint from a steel leg brace similar to those worn by polio victims.

Not forgetting safety, Adolph has a fire extinguisher mounted in the cart and a lightning rod with a ground wire and rod for the umbrella. He dislikes noise and distraction when playing golf, so the engine has a special muffler and all of his clubs are held in spring-loaded, rattle-free solid rubber brackets.

Much of last summer was spent building the cart, but Adolph is convinced that it will enable him to play golf for many more summers to come.

Walter Yurk,
Neenah, Wis.

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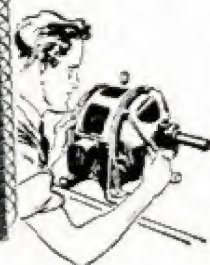
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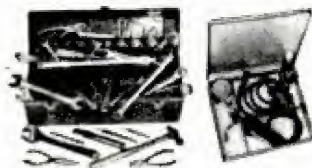
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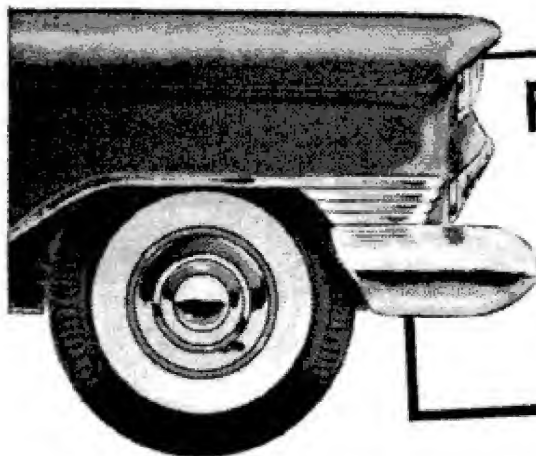


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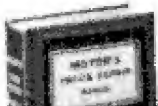
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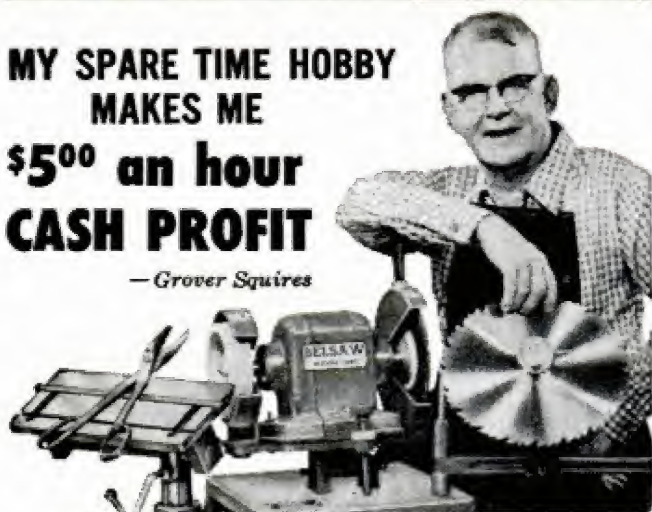


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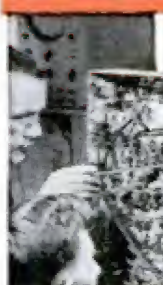


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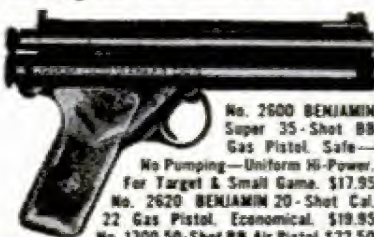
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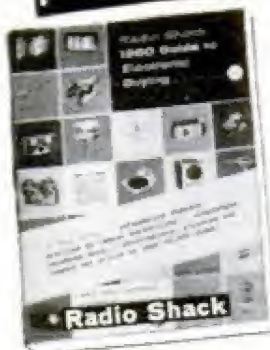
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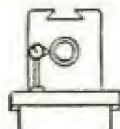
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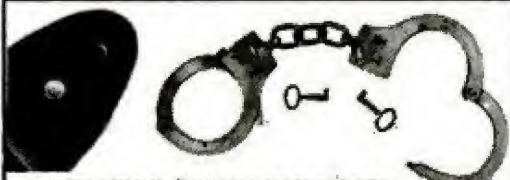




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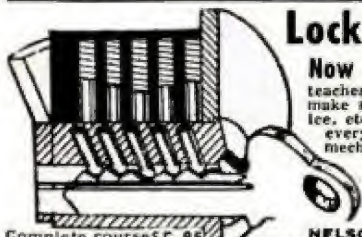
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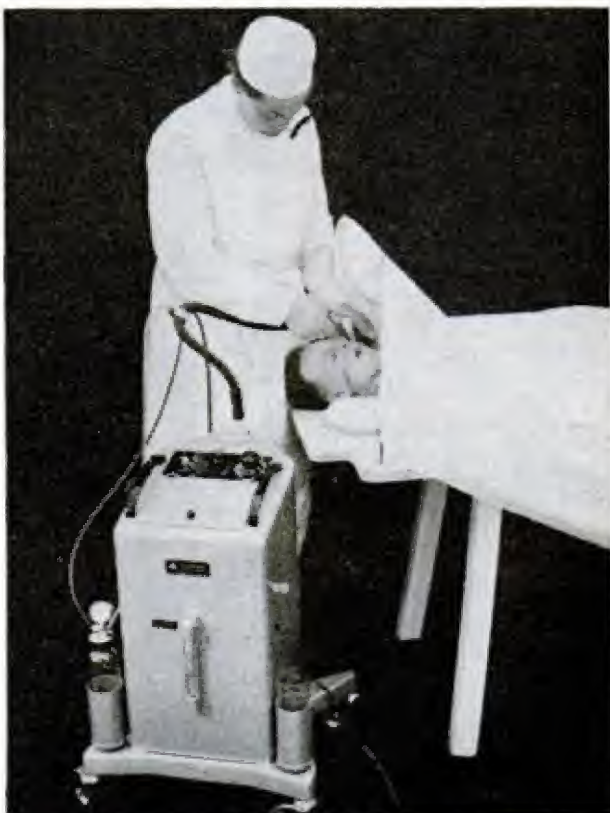
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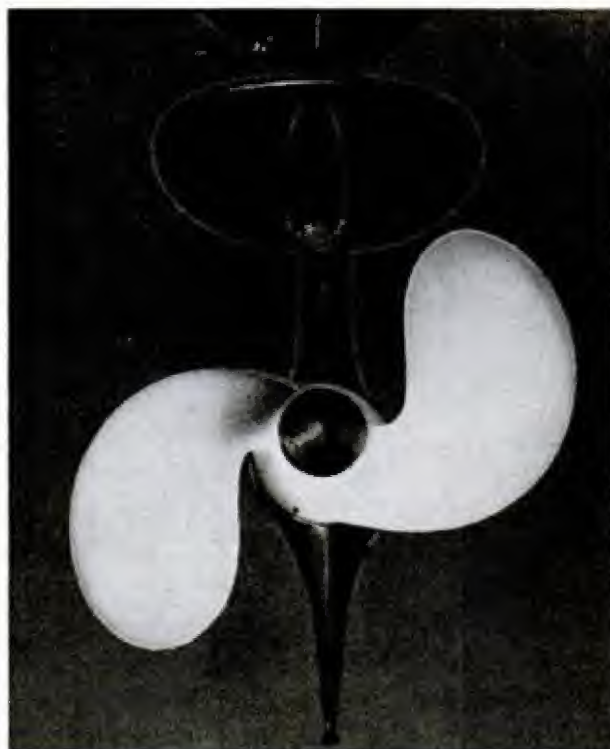
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VENDING Machines. No selling. Operate a route of coin machines and earn amazing profits. 32-page catalogue free. Parkway Machine Corporation, Dept. #26, 715 Ensor Street, Baltimore 2, Maryland.

GROW Mushrooms. Cellar, shed and outdoors. Spare, full time, year round. We pay \$4.50 lb. dried. We have 29,000 customers. Free book. Mushrooms Dept.: 173. 2954 Admiral Way, Seattle, Wash.

CIGARETTES: Make 20 plain or filter-tips for 9¢. Facts free. Moberly, Box 821, Owensboro, Kentucky.

EARN Money evenings copying and duplicating comic cartoons for advertisers. Adservice, Argyle 1, Wisconsin.

YOUR Own, easy-to-start, home mail-order business, sparetime. Fascinating; profitable! Information free. Alfano, 19-PM Pine, Closter, N. J.

BIG Money raising fishworms and crickets. Free literature. Carter Hatchery, Plains, Georgia.

READ "Progressive Mailtrade," the magazine that tells how to make money by mail. Quarter brings sample and special offer. Progressive Mailtrade, Box 357, Sheboygan, Wisconsin.

WIN Contest money. General Contest Bulletin gives hundreds of tips. Lists current contests, rules. Sample magazine 25¢. General Contests, 1609½ East 5th, Duluth 12, Minnesota.

AMAZING Successes through franchises! Become exclusive franchise holder your territory. Information rushed. National Franchise Reports, MP-528, 333 North Michigan, Chicago 1.

START Big-pay business at home in spare time. No experience needed to operate little table-top machine for bronzing baby shoes. Make \$5.46 profit on every pair. Full particulars free. Send postcard to Mason, 1512 Jarvis, Room CM-2-A, Chicago 26, Ill.

MEN—Women! Start money-making plastic laminating business at home in spare time. Material that costs 11¢ brings back \$2.50. No canvassing or selling but mail orders bring in \$20 a day. Write for full particulars free. Rush name on postcard to Warner, Room CL-2-A, 1512 Jarvis, Chicago 26, Ill.

EASY To start rubber stamp business at home in spare time. Make up to \$9.80 an hour without experience. Facts free. Write to Roberts, 1512 Jarvis, Room CR-2-A, Chicago 26.

SELL Diamonite gems; more brilliant than diamonds. Credit arranged. Catalog 10¢. Diamonite, 2420-M 77th, Oakland 5, California.

MAKE Money writing short paragraphs! No tedious study. I tell you what to write, where and how to sell; and supply list of editors buying from beginners. Many small checks add up quickly. Write to sell, right away. Send for free facts. Benson Barrett, Dept. C-27-N, 7464 Clark, Chicago 26.

IN 1952 I was unemployed, broke. Today own \$18,000 home, drive Cadillac, have bank account. Anyone can do this. Write Norris Cole, 217 West 49th, Bradenton, Florida.

OPERATE Profitable home import business! Details free. Direct Mail Service Company, Box 581, Bakersfield 10, Calif.

\$340.00 MONTHLY With jigsaw. Details. Elkman, 346F North Summit, Sioux Falls, So. Dak.

LEARN Appliance service and repair. Motors, washers, refrigeration, cleaners, everything. Free booklet. Appliance, 11027 South Vermont, Los Angeles 44.

\$50,000 YEARLY Possible. Distribute sales literature your territory. Write Afja, Box 33-D, Southfield, Michigan.

BUILD Dutch windmill and wishing well dog houses. Two plans \$1.00. Craft Shop, Peotone, Illinois.

MAKE Big easy profits making costume jewelry at home in spare time! Quick, easy to make, easier to sell! Details free! Don-Bar, 3511 W. Armitage, Dept. C-192, Chicago 47, Illinois.

START A profitable subscription business in spare time! We need men and women (young or old) as representatives for all leading national magazines. Liberal commissions on all subscriptions. Supplies free. No experience needed. Send this ad with your name and address to: Popular Mechanics, Room 3-O, 250 W. 55th St., New York 10, N. Y.

HUSBANDS And housewives wanted! Big money. Spare or full time cake decorating and candy making. Turn your kitchen into a gold mine. No age, education limits. Complete instruction, learn and earn at home. Write for free facts. Candy And Cake, Dept. 648, Fallbrook, California.

\$200 WEEKLY Buying gold. D'Amico, 24 North Wabash-A Ave., Chicago 2.

MEN, Women, students! Learn how easy it is to earn money selling the highest quality stainless steel pot cleaner on the market. Write: Springfield Wire & Tinsel Company, P.O. Box 638, Springfield, Mass.

INVISIBLE Reweaving: \$5 in one hour possible reweaving burns, tears, moth-holes. Spare-full time. Free details. Skill-Weave, Dept. WC-163, 335 W. Madison, Chicago 6.

MONEY In chemicals. Make own products. Pocket all profits. Others work for you. Details free. Ranslow, 51 W. 32 St., Hialeah, Florida.

FREE Details—How to make big money selling books by mail! Direct Mail Service Company, Box 581, Bakersfield, California.

BIG Money opportunities—Jobs, businesses, investments. Retirement opportunities. Free details. Shoreland, 20 W. Jackson, Suite 1412-K, Chicago 4.

GET Money for newspaper clippings. Free details. Write: Whitted-30A, 2815 Nicholson, Dallas 24, Texas.

NEED Money? Sell Golden Rays letters kits. Free details. Tebe, 36-08A 30 Avenue, Astoria 3, N. Y.

DANDY Homework offer. Wall Monument Works, 1071 Linden, Zanesville, Ohio.

SHOW—Sold! Cigarette vanishing trick. \$1. Details. Scheetz, Sellersville 2, Penna.

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MAKE Money typing. Details 17 proven plans. Crafts, Mulino, Oregon.

MAKE Big money operating your own home mailorder business! Full, sparetime. Specialist's complete instructions show how you can make easy start! Further particulars free. Griffin, 322 West State, Ithaca, N. Y.

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FORMULAS, PLANS, ETC.

RESILVER Mirrors—make one-way mirrors. Both \$1.00. Kem-Mir, Park Ridge, Illinois.

LATE, Modern manufacturing formulas. List free. Moon Chemical, Martville, New York.

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FORMULAS: All kinds, latest, best. Literature free. Kemixal, Park Ridge, Ill.

PLASTICS

LAMINATING Supplies. Price list free. Solomonson, 4 Beacham, Everett 49, Mass.

LEARN Plastics fabrication for spare time income. Low cost home training now available. Write for free booklet. Interstate Training Service, Dept. D-3, Portland 12, Oregon.

BOXES, Plastic. Free list. Althor, 170 Bay 23 Street, Brooklyn, N. Y.

PLASTIC And supplies for laminating. Colamco, 12 Center, New Haven, Conn.

PLASTICS—Plexiglas, polyester, fiberglass, acetate, vinylite, supplies. Manufacturers' distributor, sheets, rods, tubes, liquids, coatings, films, boat plastics. Large, small quantities. Complete instructive catalog, 25¢. Gem-O-Lite, 5529-A Cahuenga Blvd., North Hollywood, Calif.

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PLASTIC Embedding for fun and profit, no oven. Make beautiful jewelry, decorative panels, science specimen castings. Catalog 25¢. Natcol Plastics, Box 444, Yucaipa, California.

CELLULOID Scrap. Sheets, state thickness, colors. Celluloid, Box 333, Kearny, N. J.

DO-It-yourself casting-molding-modeling plastics! Clear-colors accessories. No experience or machinery necessary. 64 page catalog 25¢. Castacraft Corp., Dept. D-23, P.O. Box 555, Palo Alto, California.

LAMINATE-It yourself, easy, 6x9" package \$1.00; 9x12" \$2.00. Acetate Specialties, Major's, 1740-C Columbia, Chicago 26.

ELECTRIC Laminating kit. Easy. Fun. Profitable. Details. Burr, 330 East Center, Kalamazoo, Mich.

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AMAZING New book of science experiments, formulas, and catalogue of laboratory supplies. Only 35¢. National Scientific Co., 13 S. Park Avenue, Dept. PM-3, Lombard, Illinois.

CHEMISTRY Catalog, 25¢. Used list. Laboratory Sales, Box 161-A, Brighton, Mass.

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FREE—Six 4 inch Pyrex test tubes with every \$4.00 order. Catalog 25¢. Bio Chemical Products, 30 Somerset, Belmont 78, Massachusetts.

232 PAGE Catalog \$2.00. Laboratory Materials, 7319 Vincennes, Chicago, Ill.

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RADIOACTIVE Isotope experiments—New, 16 for 60¢. Atomic Researchlab, 10717 Venice, Los Angeles 34, Calif.

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EVERY Man a prospect. Request refundable sales kit offer showing line of belt buckles, tie clasps, money clips, cuff links, lapels, individualized with customer's name and emblems. Cap badges for trucking, bus, taxi, police, firemen also heavy construction emblems. Choice 3000 emblems. Hook-Fast, Box 1425PM, Providence, R. I.

BE The Popular Mechanics representative in your neighborhood and earn big profits in your spare time. Write Popular Mechanics, Room 3-A, 250 West 55th St., New York 19, N. Y.

MEN! Women! 60% profit on cosmetics. Famous nationally advertised Hollywood cosmetics pay 60%. Make \$25 day up. Hire others. For free samples, details, write Studio Girl, Glendale, California, Dept. 1203J.

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto Fire Extinguisher. New chemical used by Airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd, Dept. P-66L, New York 16.

WILL You test new items in your home? Surprisingly big pay. Latest conveniences for home, car. Send no money. Just your name. Kristee 72, Akron, Ohio.

SELL Nameplates! Yours; plus 100 order blanks, for \$1. King, 10 Catherine Ave., Waterbury 4, Conn.

BIG Free money-making catalog can make extra money for you! Take orders in your spare time. Show colorful catalog of jewelry, toys, gifts, greeting cards, collector's items and household gadgets. Work your own hours. No experience necessary. For free catalog, write: North Star, Dept. 6-524, 251 East Fifth Street, St. Paul 1, Minnesota.

1000 EMBOSSED Business cards at \$3.99 up to 7 lines. (Black or blue.) Free sample cards and style chart. Palinkus, 1627-PM 33, Lorain, Ohio.

AGENTS And distributors wanted to make over \$15,000 a year with sensational new spray-on shoe shine line. Write Easy Shine Co., Dept. P 360, 74 Washington St., New York, N. Y.

MAKE Money selling famous brand watches. Drake, 9026 Marcella, St. Louis 21, Mo.

POP Up mail box flag. Make money with this needed device. See picture Page 93 P.M. Jan. issue.

BIG Profits. Sell proven family medication. Low wholesale prices. Free sample. Porter's, Box P-907, Piqua, Ohio.

BIG Earnings selling amazing floor treatments, business firms, factories, institutions. Exclusive territory. Free sales kit offer. Sheridan Chemicals, 1417 Sheridan Street, Camden 4, N. J.

GOLD Or silver letters, numbers. Windows, doors, trucks. 1" to 6". 500% profit. Free samples. Atlas, Box 543-T, Oak Lawn, Ill.

RUN A spare-time greeting card and gift shop at home. Show friends samples of our wonderful new 1960 all-occasion greeting cards and gifts. Take their orders and earn up to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 58, Ferndale, Mich.

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MEXICAN Art goods! Free sample! Send 14¢ stamps mailing. Sylviak, Apartado 9036, Mexico City.

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YOUR Ad in this space will get some good agents for you. Yes, I'll prove it. Write for Folder "A", right now. F. W. Johnson, Classified Advertising Manager, Popular Mechanics Magazine, 200 E. Ontario St., Chicago 11, Ill.

SELL Champion, AC, Autolite spark plugs. Reconditioned, electroplated, guaranteed 10,000 miles. 100% profit. Free sample. Lee Plugs, 1608-E Roberts, Houston 3, Texas.

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WHOLESALE: 850,000 items. Supply source directory 25¢. Idealer, Park Ridge, Illinois.

ELECTRIC Guitars, amplifiers, wholesale. Free catalog. Carvin, PMW, Covina, Calif.

BUY Wholesale: 100,000 nationally advertised products. Appliances, cameras, sporting goods, housewares, watches, typewriters, tools, clothing, etc. Discounts to 60%. Buy-Rite, Box 258, Hawthorne 2, New Jersey.

USED And new watches \$3 up. Free list. Southern Watches, 5-PM So. Wabash, Chicago 3.

LARGEST Wholesale supply source in U.S.! Furniture, clothing, appliances, housewares, automobiles and accessories, tools, sporting goods, hobby supplies, farm equipment, imports, new products, bargain merchandise. Free details. Associated Wholesalers, Box 2068-DD, Sioux City 4, Iowa.

BUY Nationally advertised products at discounts to 60%. Appliances, watches, cameras, clothing, housewares, jewelry, toys, typewriters, tools, etc. Stephens Distributing Co., Box 1434, Atlanta 1, Ga.

NEW Multicolor wholesale catalog, automobile catalog, and others. Housewares, appliances, refrigerators, freezers, washers, dryers, television, radios, furniture, clothing, luggage, binoculars, photographs, recorders, cameras, projectors, typewriters, sewing machines, power tools, toys, sporting goods, watches, jewelry. Name brands. Huge discounts. Postcard: Selbyco, Decatur, 154, Illinois.

2,000 PAGES Wholesale catalogs. Write: Mopam, Box 47, Newark, Ohio.

FREE Wholesale catalog! Housewares, appliances, watches, 25¢ refundable. French's, 1804 So. 23rd St., Louisville 10, Kentucky.

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SAVE 80%. New illustrated wholesale catalog 25¢. Cam, Barrett Hill, Lake Carmel 3, New York.

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WORLD'S Largest wholesale supply! Buy from 257 American, European, Japanese wholesalers. Tailormade suits from Hong Kong. International Buyers, 216-M Jackson, Chicago 6, Ill.

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ANYONE Can sell famous Hoover uniforms for beauty shops, waitresses, nurses, doctors, others. Miracle fabrics—nylon, dacron, wash 'n wear cottons. Exclusive styles, top quality. Big income, real future. Equipment free. Hoover, Dept. C-100, New York 11, N. Y.

MAKE Extra money selling advertising matchbooks. Free catalog and sales outfit. Matchcorp., Dept. PM-30, Chicago 32.

BUSINESS Kit free! Postcard puts you in business! Complete line 230 shoe styles, jackets! New discoveries pay big commissions. No investment. Send for free kit. Mason, Chippewa Falls R-304, Wis.

\$1,000.00 A Month for making dramatic 3-second demonstration of amazing lightweight Presto Fire Extinguisher. New chemical used by Airforce snuffs out fires instantly. Only \$4.95. Terrific commissions. Millions want it. Free kit. Merlite, 114 E. 32nd, Dept. P-66L, New York 16.

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MAKE Up to \$50.00 a day soliciting delinquent accounts. Terrific commissions. Write today. National Credit, 304Y Pickwick Bldg., Kansas City 6, Mo.

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SERVICE Your area. Agents, dealers, farmers make \$125 up weekly distributing nationally advertised Campbell's Gro-Green Liquid and 100% soluble crystal fertilizer concentrates. No investment. Demonstration kit furnished. Campbell Co., (Est. 1928), Rochelle 5, Ill.

YOUR Free copy of world's biggest sales magazine tells you how and where to make more money on your own in selling. Write Specialty Salesman Magazine, Desk 5B, 307 North Michigan, Chicago 1.

IF You're interested in making money in selling, see the hundreds of exceptional opportunities in Salesmen's Opportunity Magazine. Send name for your copy, absolutely free. Tell us what you're selling now. Opportunity, 848 N. Dearborn, Dept. 17, Chicago 10, Illinois.

SELL The hottest line of fishing tackle in 1960. Over 40 items. Free details. Samples \$3.50 value. \$2.00. Pat's Fishing Tackle, Box 164-P, Sheboygan, Wisconsin.

JOBBERs. Distributors, salespeople. Buy direct from manufacturer. Finest Austrian Aurora Borealis crystal jewelry. Sample necklace and earrings \$3.00. Borucki Jewelry Manufacturers, Box 2016-Noble, Bridgeport, Conn.

DO You sell from your car or truck. Big profits in selling cleaning polishing cloths sets. Sample prepaid \$1.00. Refunded on first wholesale order. Meyer Company, Box 868, Galesburg, Ill.

EARN Big commission full or part time. Build profitable business of your own selling America's largest line low priced business printing. 360 page catalog, samples, hundreds of items used daily by business people. Imprinted ball pens low as \$8.95 for 100. Calendars low as \$5.95 for 100. Free sales kit. National Press, Dept. 8, North Chicago, Illinois.

SALESMEN And distributors, full or part time, sell outdoor advertising pennants. Write: Radder Products, Box 31, Colvin Station, Syracuse 5, New York.

WILL You wear new suits and topcoats without one penny cost and agree to show them to friends? You can make up to \$30.00 in a day even in spare time, without canvassing. J. C. Field & Son, Inc., Dept. C-1828, Harrison & Throop Sts., Chicago 7, Ill.

EPOXY Coatings and other advanced building maintenance materials pay top commissions, repeat orders, protected territories. Paramount, Box 1956, Cleveland 6, Ohio.

EXCELLENT Profits. Signature rubber stamps. Sample, details \$2.00. Boardman Engravers, Houghton, New York.

FREE! Private labels! Exclusive sales! We supply product, plan literature; you provide management, sell wholesale, employ salesmen. Terrific profits and repeats. Sample and details free. Vitamins, 2908-E Beverly Boulevard, Los Angeles 57.

AD Specialty men. New short exclusive prestige line, with large sales potentials. Karvart, 6005 Crescent Blvd., Camden, N. J.

AMERICA'S Hottest Item! 50 Star Flag. Sell homes, dealers, institutions, industry, banks, etc. Sample \$5.00. Free particulars. Atlas Flag Corp., Inc., Benton, Ill., or Hahneo, 418 St. Paul St., Rochester 5, N. Y.

POP Up mail box flag. Make money with this needed device. See Picture Page 93 P.M. Jan. issue.

PERSONALIZED Rubber tu-tone door mat with home owner's name. Carry no stock. Deposit is your profit. We ship parcel post c.o.d. for balance. Sample with sales proven name "The Gordons" \$1.00 postpaid. No samples c.o.d. Free details. O'Brien Mats, 2110 San Fernando Rd., Los Angeles 65, Calif. Established 1925.

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JOBS On ships. \$100 weekly, beginners. Travel, adventure. Write: Seamans Service, Box 17-M, Brooklyn 8, N. Y.

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MONTANA. Proposed Libby Dam information. Housing, opportunities, employment, etc. \$1.00. Box 798, Libby Montana.

JOBS In California Newsletter. 50¢ month: \$4.50 year. Monadnock Bldg., San Francisco 5.

U. S. A., Foreign jobs, up to \$1500.00 monthly. Construction, clerical, supervisory, etc. Skilled, unskilled. Free transportation. Unusual opportunities. Complete information plus worldwide project listings. Only \$2.00 (\$2.25 airmail). Satisfaction guaranteed. International Reports, Dept. J, P.O. Box 621, San Jose 6, California.

AMERICAN Overseas jobs. Higher pay. Transportation paid. Men-women. Write today. Free information. Employment Headquarters, 79 Wall Street, Dept. B-6, New York 5.

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BOOKS, Free general catalog, 100 pages. Text, vocational, educational, instructional subjects. Millions of volumes, new and used. Bargain prices. Books bought. Est. 1902. Long's College Book Co., Dept. PM, Columbus 1, Ohio.

PIANO Tuning pays. Big money in spare time. Learn at home in 30 days. No musical knowledge necessary. Phonograph, records, tools and instructions furnished. Personal instructions available. Free catalog. Capital Piano Tuning School, 3160 S.W. 16th Court, Fort Lauderdale, Fla.

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INVESTIGATOR Training—Robert B. Phillips Sr., Founder, former U.S. Government Special Agent. Write to 1917-K North Kenneth, Chicago 39, Ill.

USED Correspondence courses and books sold and rented. Money back guarantee. Catalog free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

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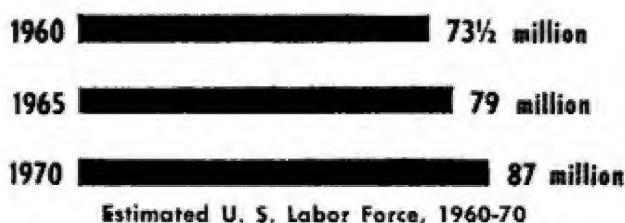
At a time when automatic machines and mechanized techniques are coming into widespread use, the *skill of the individual worker has more meaning and value than ever before.*

Our need for trained and ingenious workers, each with his gifts at their fullest development, has increased in direct proportion to the ingenuity and complexity of our machines. It has placed an exclamation mark upon their individuality.

We are beginning to see that we have a considerable manpower problem, and are moving to find solutions for it. There is room to wonder, however, if enough people are aware of the problem, if enough people are attacking it, to achieve the kind of results we are going to need to guarantee the strength, security and prosperity of our country in the years ahead.

The demand for skilled workers has been out-running the supply for several years now. Our industry is short of engineers and scientists, short of clerical help, short of managerial personnel, short of craftsmen, short of qualified semiskilled workers. The pinch gets tighter as the economy grows and as our national appetite for goods and services grows in billion-dollar gulps.

The implications of these current shortages for the future health of the economy are the subject of some recent studies by the U. S. Department of Labor. The charts below point out what some of these anticipated changes will mean.



The chart shows that 13½ million workers are expected to be added to the labor force between 1960 and 1970. At the rate the population is growing, achieving this size labor force will not be a problem.

We can expect the labor force, which stood at 73½ million in 1960, to reach the expected 87 million by 1970.

The problem is: *will they be the highly skilled, highly trained workers we will need* to man an increasingly complex defense system and to satisfy an ever rising level of consumer demand? They can and should be, but there are some difficulties.

Of the 13½ million additional workers who will be in the labor force in 1970, almost fifty percent will be young and inexperienced (under 25) and another forty percent will be relatively older (45 years and older). The remainder will be between 25 and 34, and there will be an actual decline in the prime working age 35-44.

This changing balance of age is a matter of startling significance to a nation which has traditionally sought the young male worker between 24 and 44 at the expense of all other groups. We are going to have to change our attitude toward the older worker and the youthful worker if we are going to succeed in our search for the quality skills necessary to achieve the economic growth our technical accomplishments have made possible, and which our population growth has made necessary.

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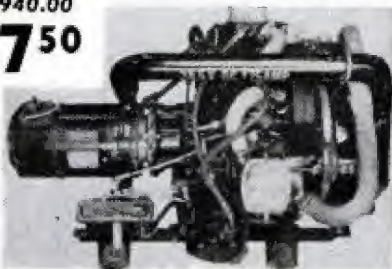
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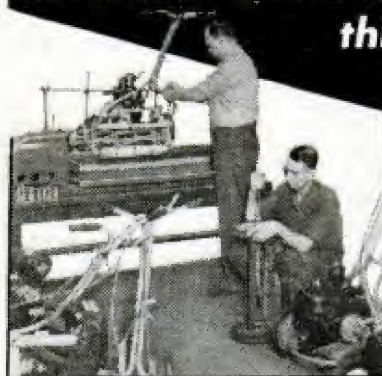
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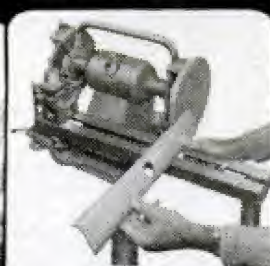
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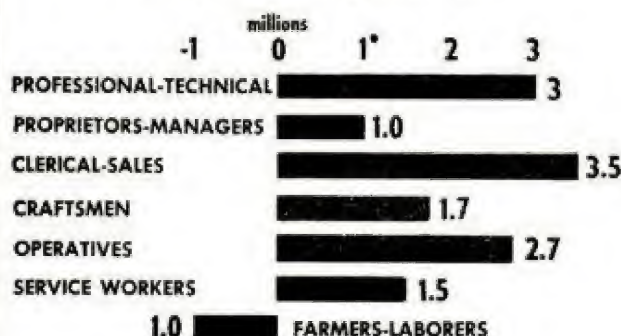
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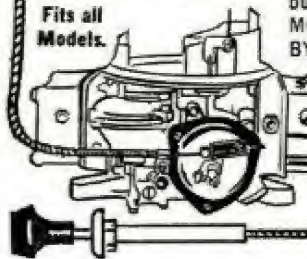
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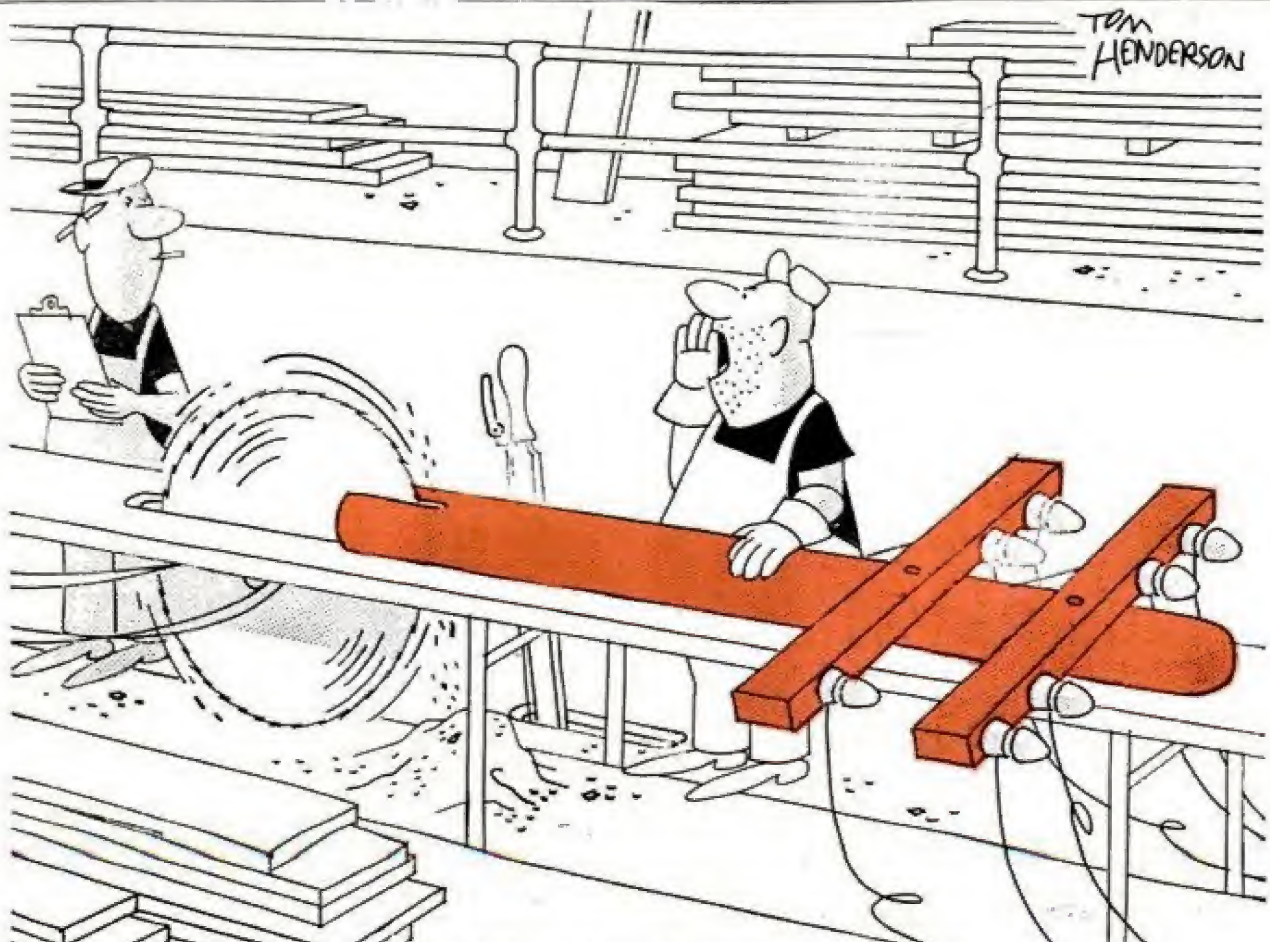
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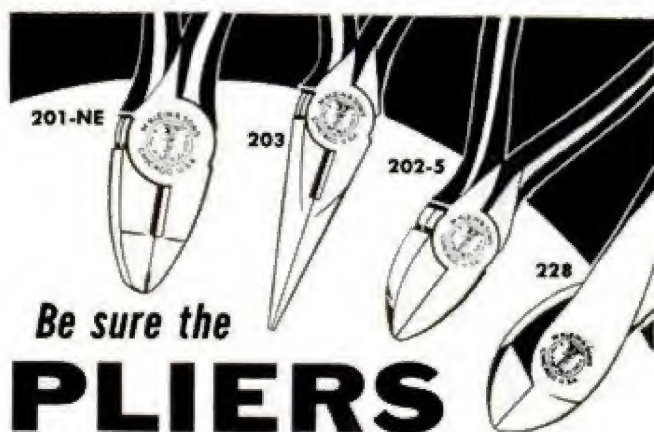
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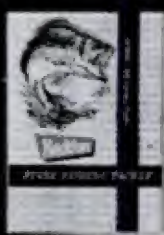
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Top Medical Achievement of 1959: Genetics Research

Biochemical genetics—the scientific field that deals with man's origins, his mode of development and reproduction of characteristics—was selected by deans of 84 medical schools as the field of greatest medical achievement during 1959, according to the American Medical Association.

Many biochemical geneticists are looking to the day when man can plan himself to the extent of improving his intelligence, physique and resistance to disease. One dean, Dr. Stafford L. Warren of the University of California, described one experiment that brought a better understanding of the biochemistry of nerve impulses. This might result in better methods of treatment for mental health problems.

"It has been possible to trace, on a brain-wave detecting device, records of the learning process," he said. "As an animal at our center learned a particular task during the past year, a tracing of a new electrical activity in a particular brain area could be recorded. This could be erased with drugs that caused the animal temporarily to forget, but the tracing returned as the drugs wore off."

Dr. Thomas H. Hunter, dean of the University of Virginia School of Medicine hailed the April announcement, by British investigators, that an irregular number of chromosomes inside living cells are re-

sponsible for grave conditions such as Mongoloid idiocy and, possibly, leukemia. Chromosomes are the microscopic life-threads that carry genes of heredity—such as eye, hair and skin color—like beads on a string; they are found inside germ cells that unite to form new organisms. "These findings," said Dr. Hunter, "clearly and unequivocally label such abnormalities as genetic in origin."

The deans praised the work being done in genetic research centers throughout the country. They said that among other projects scientists were investigating:

1. The phenomenon, technically known as transduction, through which a virus can carry genetic material from one cell to another, a significant step in the field of transplantation of organs.
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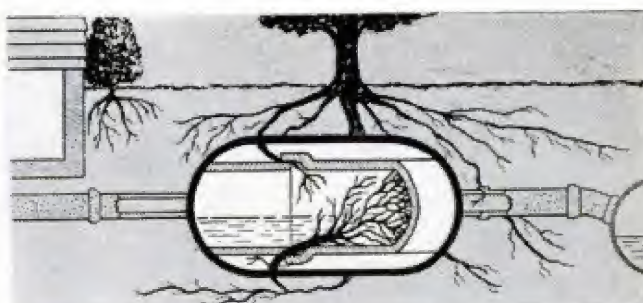
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Perpetual Spouter Is Born in Oregon

Charles Crump, a rancher in southern Oregon, today irrigates his fields with water from a geyser-like flow that began spouting on his property last July. Despite predictions by engineers that the loose soil through which it jets would crumble, blocking its passage, the spouter has continued to plume water to heights of between 150 and 200 feet, or some 30 to 80 feet higher than Old Faithful in Yellowstone National Park. Geologists say the spouter is not a true geyser because it is not an intermittent, eruptive hot spring in which discharges, caused by the expansive force of highly heated steam, occur at more or less frequent intervals. Nonetheless, it is known as Crump's Geyser, for the rancher not only has it on his property, but he was the first to see it in action. Crump had leased out a section of his land, which abounds in hot springs, to a company which drilled a well in a search for high-temperature water that could be used to make power. The company abandoned the site after drilling 1684 feet. Crump, curious because the well was seemingly a failure, visited the site frequently. On July 1, when he inspected it at 1:15 p.m., bubbling water was present at the well casing, and the hole was free of debris, indicating an eruption had occurred. As he and a neighbor watched, the spouter erupted at 1:55 and has been flowing ever since. Crump's gain, however, was a loss for hot-spring activity in the area: A hot spring 100 yards east and a geyser 100 feet north have become inactive.



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Experimental Reactor Will Distill Sea Water

Two U. S. government agencies will use nuclear energy to distill huge quantities of fresh water from sea water, beginning January, 1962, at Port Loma, Santa Monica, Calif. The Department of Interior is building a \$2,000,000 flash distillation unit there which is capable of producing at least one million gallons of fresh water a day. It will take its power, most of the time, from an experimental, nuclear-powered reactor the Atomic Energy Commission is building at a cost of \$4,000,000.

The reactor will be used in experiments to determine whether it is suitable to provide power for industries producing primary metals, petroleum, coal, chemical, food and paper products. At times the conversion plant will be powered by other fuels. To prevent radioactivity from entering into the distillation process, the reactor has three barriers to separate it from the conversion equipment. In operation, high purity water will circulate through the reactor, will be heated, and then converted to low-pressure steam in a boiler. The low-pressure steam will then heat the sea water in the flash evaporator. It is hoped that the flash distillation unit, operating at higher than normal temperatures, can produce water at low cost.

Normally, to produce 50 million gallons of distilled water per day (10 percent of the water used in Southern California) gas-fired boilers would utilize 20 percent of the gas now used in the area. This would seriously affect the balance of fuel supply, whereas a nuclear reactor could supply this heat at about the same cost and, if the experiment proves successful, the heat would be readily available.

Planes Are Hired Hands For California Farmers

Airplanes are helping California farmers produce crops efficiently and economically by sowing seed and spraying fertilizer, says Milton D. Miller, University of California agronomist. He estimates that 15 percent of the state's three million acres of cereal grain and hay crops are sown by planes. They include barley, wheat, oats, rye, vetch, alfalfa, trefoil, clover and rice. Rice growers, Miller said, are the greatest users of planes for seeding; some 95 percent of the 300,000 acres of rice planted are seeded from the air. All told, in 1958, California farmers hired 221 firms with 702 pilots and apprentices flying 1389 planes to give crop protection by spraying 5,308,542 acres with chemical fertilizers, herbicides, insecticides or fungicides.

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U.S. Navy Men in Antarctica Thank a Ham Radio Operator

When men of the U.S. Naval Support Force stationed at McMurdo Sound, Antarctica, during the past six years have wanted to make personal calls to their families, they have relied on Julius Madey, a 19-year-old ham radio operator at Clark, N. J., to "patch" their short-wave conversations into the telephone circuits. Julius, an electronics engineering student at Rutgers University who, in 1958, was given the Edison Radio Amateur award for his contributions to public service, has spent as many as 90 hours a week passing messages to and from the Sound, or sending along to the Navy men such prized information as baseball and football scores. Last November, as a gesture of thanks, the Navy men flew him to Antarctica with an invitation from the Secretary of Navy to inspect their



base. His first stop on arrival was at the short-wave station, earning him further gratitude from the Navy radio operators, one of whom has said, gratefully, of Julius's service: "You can depend on him; he's always there."





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This Month's "Great Pioneer in Science"

(Page 16)



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Tom McCahill Reports on: *Facts about Replacement Mufflers*

Today's automotive tastes have caused very complex designs and some weird engineering. Underslung styling, high compression engines, and power-assist gadgets have become common. This has created new problems in maintenance. Let's consider mufflers, for instance.

Typical current hopped-up Detroit gargantuas demand a different type of food than old-time cars. They take to 100-plus octane gas like a cokie to a needle, and they pump acid-loaded fumes into the muffler that can eat a hole through it like a rat through cheese. This calls for better-designed mufflers. They must be built to nestle into the maze beneath today's underslung wagons. This is doubly tough with dual exhaust systems, and it all results in shorter muffler life.

Mufflers are the most common replacement item on modern automobiles. The big question is: What are the muffler kids doing to increase muffler life? The answer: there are only three things they can do. First, use heavier steel. Second, design the interior to reduce acid-loaded condensation and avoid cold spots. Third, coat mufflers with corrosive-resistant materials. AP mufflers stand out on all three counts like a well-filled Bikini at a kids' swimming pool. APs have more and heavier internal parts, much heavier outer shells and heads than other mufflers. AP's exclusive "Dri-Flow" design eliminates cold spots—cuts down on corrosive condensation. And AP offers more mufflers with rust-resistant coating than any other manufacturer. Yet AP mufflers sell for the same price as inferior gas traps.

These are among the reasons why AP is the world's largest manufacturer of replacement mufflers. Look for the big AP "Free Muffler Check" sign. More than 100,000 automotive experts, coast to coast, install AP mufflers and tail pipes.



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British scientists have developed a light-intensifier that makes pulses of light energy 50,000 times brighter and turns images too faint to be seen by the naked eye into visible patterns that can be photographed. The intensifier is expected to be used in astronomy and hospital X-ray examinations. Its developers at the Imperial College of Science, London, say the ability to photograph sky bodies by almost instantaneous exposure through the intensifier would largely overcome the problem of disturbances in the earth's atmosphere encountered with lengthy telescope exposure, and opens up the prospect of examining spectra of some of the faintest stars.

The intensifier comprises a glass vacuum tube about 18 inches long by 2 inches in diameter. It operates by focusing the original faint picture onto a light-sensitive cathode inside the tube. The cathode emits electrons which are passed through five dynodes situated along the length of the tube. From every 20 or so photons (atoms of light) that fall on the cathode, one electron is produced. Each electron from the cathode hits each successive dynode at high speed, being accelerated along its course by more than 1000 volts of electricity. Each dynode will produce some five new electrons and these in turn hit the next dynode (a dime-size film of aluminum encased between a layer of aluminum oxide and one of potassium chloride) to be multiplied again. At the end, at least 3000 electrons are produced for each one leaving the cathode. An accelerating electric field throws them against a fluorescent screen, producing a visible flash of light 50,000 times brighter than the source.

Needle-Thin Radar Will Identify Missiles

More than a dozen needle-narrow microwave beams, fired from a unique radar system, will track ICBMs thousands of miles away and identify their warheads. To be developed for Advanced Research Projects Agency by Raytheon, the radar, called "Pincushion," will keep a continuous track on the missiles. The beams, fired from a parabolic, five-story-high antenna, will help produce sharp, high-definition target "pictures." The 80-ton radar is to be completed by late 1961.

Undersea Phone and TV Cables Will Link British Peoples

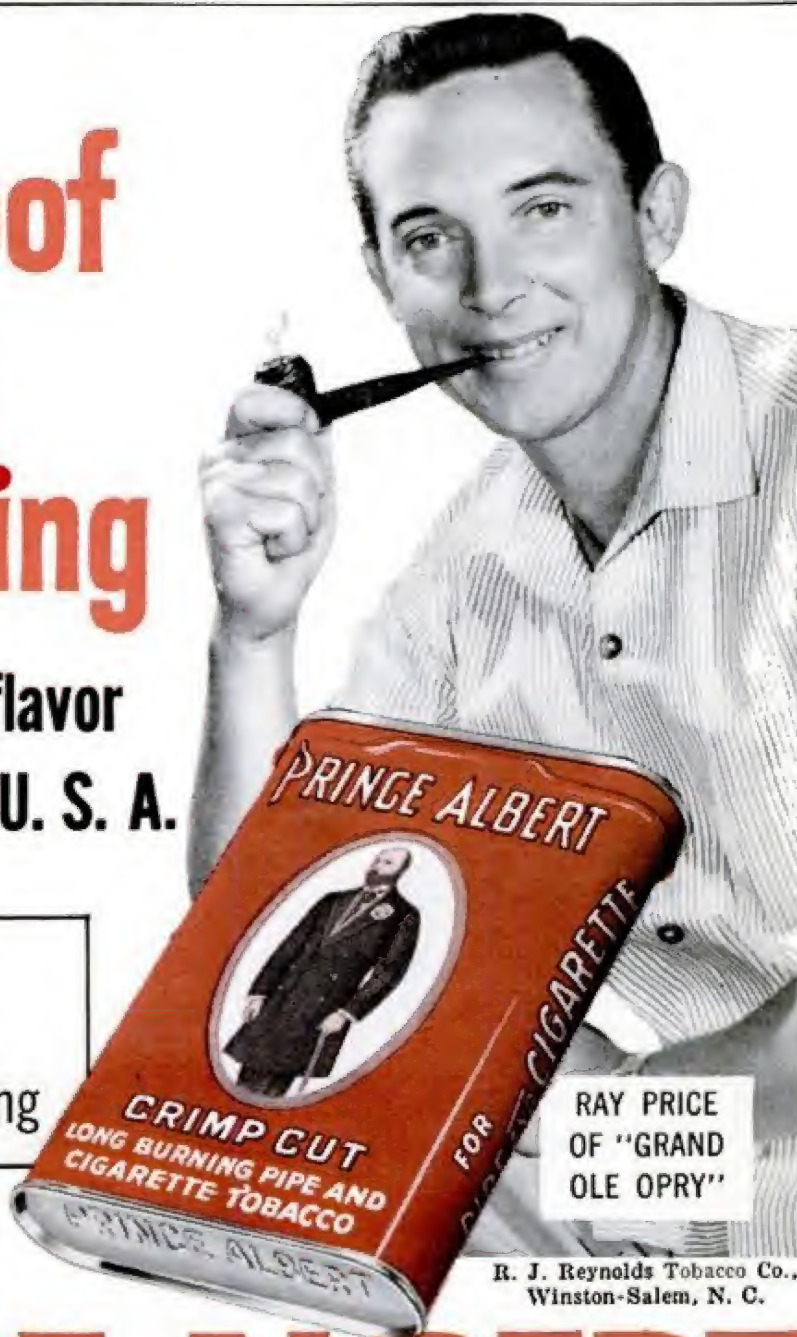
Undersea cables which carry "piped" television and telephone calls will link the whole of the British Commonwealth. First link will be a Britain-to-Canada cable, ready by 1961. By 1964, Canada and Australia will be joined, as will all main parts of the Commonwealth within the decade. The television pictures carried in the cables will be delayed TV, which are relayed immediately after the event but take about two hours in transmission. Cost of the global link will be over \$200 million.

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Mysteries of the Moon

By Paul Brock

Imminent journeys of man to the Moon may soon solve the mystery of what scientists call "Moon illusions." Some of these illusions have not been explained by even the most practical men of science.

For instance, look at the way the Moon fools us about its size as it rises and crosses the night sky. If we stand upright, the Moon on the horizon looks about three times the size of the Moon when it is overhead, but camera film shows it to be practically the same size all the while it is visible. Astronomers have been trying to explain this illusion for centuries, saying the Moon looks larger on the horizon because we compare it with trees and buildings in the line of sight, or that dust particles in the air distort our view. But any sailor will deny this, for at sea, without trees and dust, the illusion is just as great.

Oddly enough, the Moon's size stays normal if we look at it through a tube, or bend over and look at it through our legs. A man with one eye has no illusion.

One reason that the Moon's illusions are baffling is that there is usually some truth in them. Many doctors believe that certain abnormalities occur with the new moon in the human mind and body, but they don't know why. This is the origin of the word "lunacy," derived from the Latin "luna."

Farmers of former days used the magical influence of the Moon in their farming. An increasing moon was favorable to productivity, a waning moon the opposite, they thought. Under a waxing moon, grain was cut, eggs put under hens, sheep sheared and manure spread. Seeds were sown under a waning moon, so that plants could grow with the Moon. Even today, apple growers in Devonshire, England, gather fruit under a waning moon, believing that apples bruised at that time can be preserved without ill effect. In a series of experiments, Dr. Rudolph Steiner reported that maize planted two days before the full moon "ran away" from that planted two days later. Canadian farmers, in a test, reported that maize planted with the waxing moon yielded 30 to 40 percent more than that planted with the waning moon.

Another mystery is that the full moon is nine times as bright as a half moon, instead of being only twice as bright.

Such "Moon illusions" are a long way from being solved. Many scientists feel that the first men on the Moon will explain them. But others say that the lunar pioneers will face a great many additional illusions.

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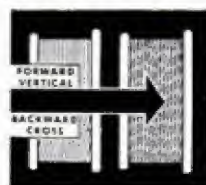
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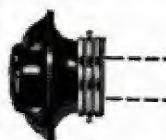
Variable speed level-wind (slower on forward motion) alternates a layer of cross with a layer of level winds. Eliminates line wedging, lets line flow off smoothly for longer casts.



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Urban Areas Engulf Resources

Urban growth in the United States—by causing cities and suburbs to spread out—is quietly locking up some of the nation's treasure in natural resources.

In California, where population has been increasing about 500,000 a year, the loss of resources is considered so serious that strong action has been taken in some instances to protect valuable natural assets.

New families require new roads, houses, stores and so on, and the buildings themselves require such raw materials as sand, gravel, cement and gypsum. Hundreds of tons of these materials are used every month in California. And here's what is happening, according to Harold B. Goldman, California Division of Mines' sand and gravel expert:

Producers of low-cost raw materials at first work deposits close to consuming areas. As the expanding community engulfs the mining operation, the residents regard the operation as a nuisance and apply close controls. The operators often leave at that point for another natural deposit which may not be so easily worked and which is farther away. This kind of move adds cost to obtaining materials.

Many undeveloped mineral deposits are now ringed by population centers and cannot be exploited owing to the difficulty of hauling materials through these cities.

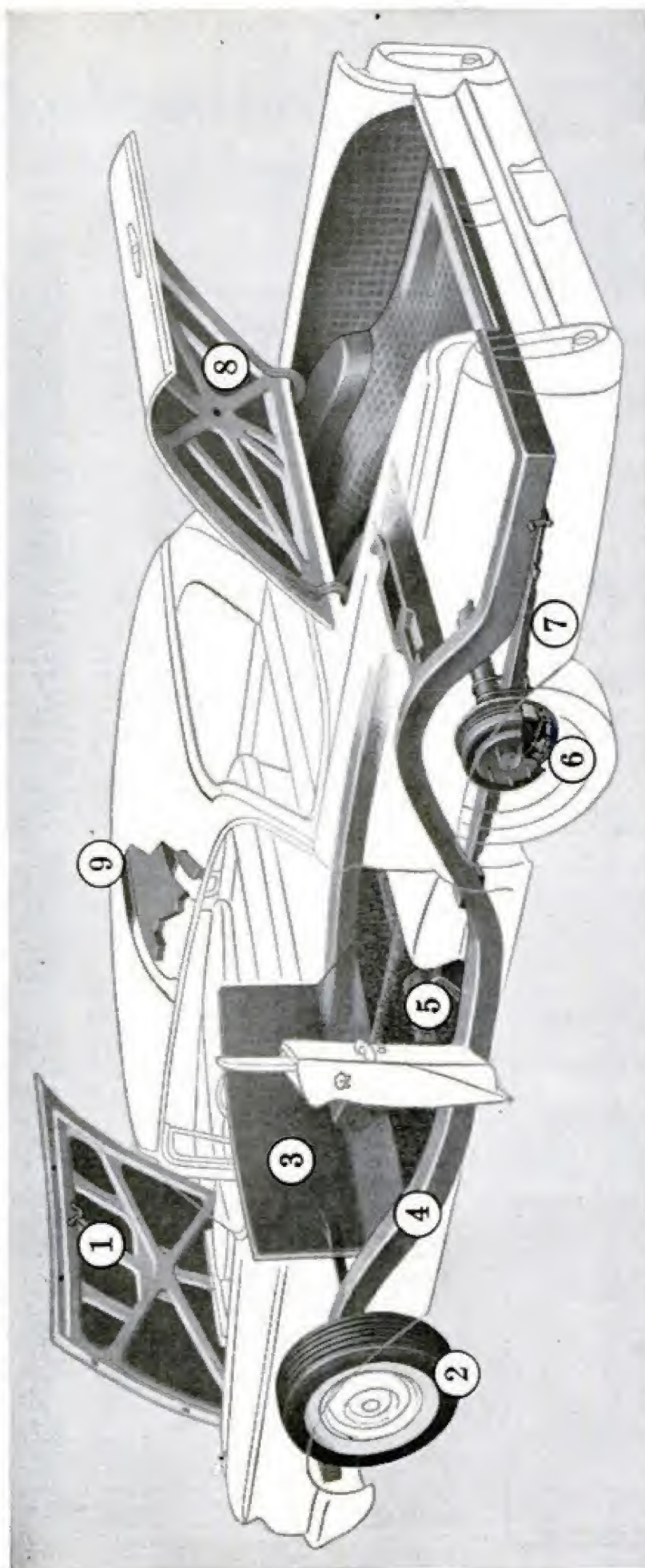
Alarmed at the subtle but insidious effects of its explosive population growth, Santa Clara County implemented a plan to protect agricultural land from the onslaught of urbanization. In 1958, it set aside 40,000 acres in "greenbelts" zoned exclusively for farm use. Factories are banned.

In Los Angeles, consulting engineers were called to study sand and gravel resources in the San Fernando Valley. Areas suitable for production have been firmly zoned as gravel-pit sites. After depletion, they are to be restored for home sites.

Pits and quarries can be made more acceptable in a community through camouflage, using a protective strip of trees and shrubs to make a parklike area. On occasion, unusual byproducts are obtained from a mining operation. For example, a worked-out quarry has been filled with water and made into a recreation area. In Fresno an adobe-brick operation also helped level the ground for irrigation.

Recovering resources does not need to mean destruction to good farmland. It is entirely possible to strip off the topsoil and "bank" it until the operation has been completed. Then the soil is replaced.

How to build a BETTER CAR



1. To prevent hood flutter and "drumming" use a double, rather than single, panel construction. Sandwich in a thick layer of asphalt-impregnated insulation to absorb engine sound. Hinge from the front for extra safety.
2. For extra traction and a softer ride use large tires (8.00 x 14).
3. To protect front seat passengers from engine sound and heat, use compound insulation for the dash panel. Install a thick blanket of high density glass fiber reinforced with a heavy mastic-impregnated face board.
4. For extra safety, use a box-type frame where the side rails safely surround the passenger compartment. These will act as effective side bumpers, help protect passengers in case of collision.

5. To check road noise, use asphalt-impregnated waffle paper on toe riser and on floor panels in front of seats. Also under rear seat. Next, cover floor panel with a heavy jute pad. Finish with "wall-to-wall" carpeting. Use a mastic deadener on underside of floor panel.
6. To eliminate the need for periodic adjusting, install self-adjusting brakes.
7. For maximum riding comfort install extra wide (2½"), extra long (60") rear springs with six leaves rather than four.
8. Build deck lid in same manner as hood: double-panel insulated construction. Cover trunk floor with waffle insulation and rubber mat. Install decorative side panels. Leave plenty of room for maximum luggage load.

Install spare tire in back of trunk away from normal-usage area.

9. To obtain an even greater degree of protection from heat, cold, and noise, place strips of waffle-felt insulation between roof bows and roof panel. Install four glass-fiber blankets on the underside of the roof panel between the bows.

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As a service to our readers in solving the hundreds of problems pertaining to a home—inside or out—the editors of *Popular Mechanics* invite you to present your problems to The Clinic Editor for help and advice. Address your questions to The Clinic Editor, *Popular Mechanics Magazine*, 200 East Ontario Street, Chicago 11, Ill.



Wallpaper Over Textured Plaster

Q—The walls of my living and dining room are plastered and textured and have been decorated with paint for many years. The texturing appears to have been done with a sponge, the surface being quite rough but lacking any regular pattern. I've often wondered if it is possible to apply wallpaper over this plaster. On some areas I believe it would be

possible, but on others where the texturing seems to be more deeply worked, I'm rather doubtful. Can papering be done satisfactorily over a textured wall?—T.H., N.J.

A—It can be done, of course, but we hesitate to recommend that you try it. If you experiment with a small piece of wallpaper of your choice you will see why. No matter how carefully you work it is practically impossible to force the paper to assume the contour of the surface without breaking at some point. It is difficult to keep the sheet straight while it is being applied. It is not possible, at some points along the edge of the sheet, to form a perfect butt joint with an adjacent sheet. This, of course, is due to the irregularity of the surface. Finally, in order to adhere securely, the paper must take the contour of the surface over which it is applied. In doing this it will reproduce the irregularities of the texture pattern, which may, or may not be desirable. These are reasons why we hesitate to advise for or against the application of paper over a textured wall surface.

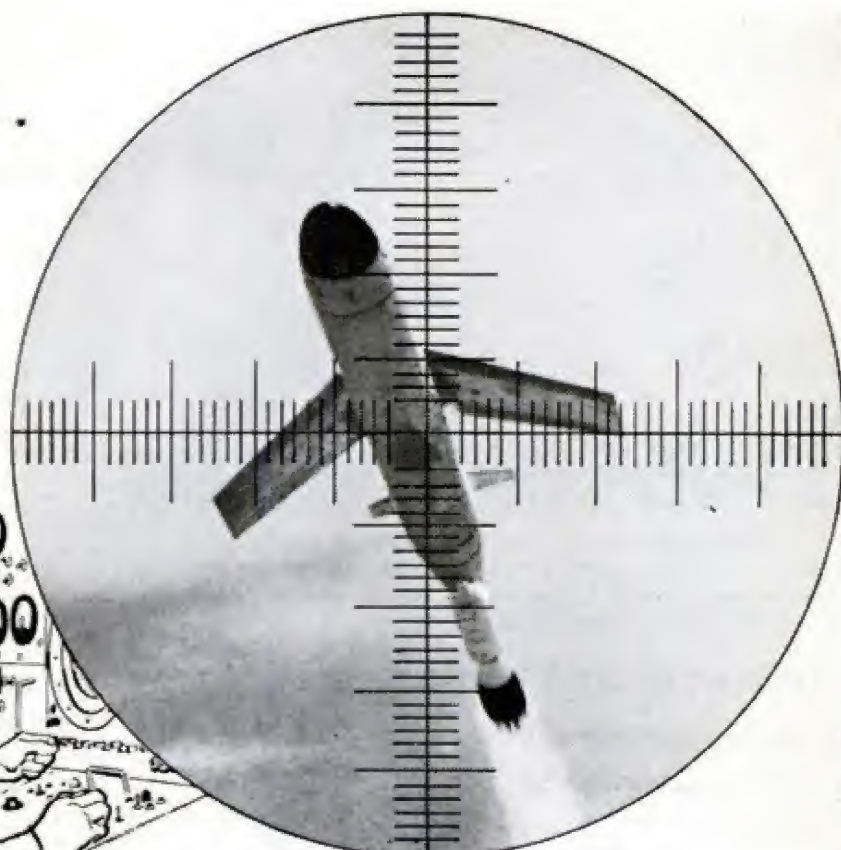
Are Old Tools Valuable?

Q—Recently I was about to discard a number of old woodworking tools (they're family heirlooms), when a friend told me they are valuable as antiques. Are they? And how valuable?—N.A., Wis.

A—We do not appraise antiques. It is true, as you have been told, that certain old woodworking tools are quite widely sought by collectors. It is probable that the value that attaches to the individual tool is determined, to some extent at least, by such factors as condition, whether in working order or not, and its desirability to the serious collector. Also, it is quite probable that a very special value attaches to some items simply because of rarity, and not because of any use value to the collector. As an example, old surfacing planes and molding planes are fairly common and sell at what are usually considered very reasonable prices, but an original bow drill used by an early colonial craftsman would likely command a relatively high figure due to its scarcity.

(Continued to page 94)

“All personnel . .
clear the firing area . . .
stand by for
countdown . . .
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7 . . . 6 . . .
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(Continued from page 92)



Drilling Small Hole In Plaster

Q—I need to drill several small holes in plaster. Using a twist drill seems to chip out the plaster around the hole. I tried resharpening the drill at different angles but did not succeed in correcting this tendency. I also tried sticking tape over this point where the hole was to be drilled, but this didn't help as small pieces of plaster came out when the tape was removed. Is there a way to do it?—N.O., Ore.

A—If the twist drill could be held perfectly straight while the hole is being drilled you would not experience this trouble. The fact that in drilling by hand you tend to wobble a bit causes the drill to bind against the side of the hole. This is what breaks out the small pieces of plaster. If you have a high-speed portable electric drill you can usually drill holes in plaster without chipping. But if you must use a hand drill, then it's best to improvise a suitable "bit". Cut off the head of a nail, the body of which is smaller than the diameter of the hole required. Flatten the pointed end slightly and then grind the flattened point to an included angle of about 10 deg. Make a light punch mark in the plaster at the point where the drill is to enter, then start the drill, using very light pressure at first. A drill improvised in this manner is quite reliable as it does not bind and rarely causes chipping.

Open Joints In Tile Floor

Q—Some months ago I laid tile in my kitchen and now I notice that some of the joints have opened and several of the tiles are loose in front of the sink. My problem is what to do. If some of the tiles are loose then isn't it likely that they will all loosen in time? And should I replace only the loose tiles or should I relay the whole floor?—W.R., Okla.



A—Several questions immediately come to mind. The answers to these might pinpoint the cause of the trouble. Did you follow the instructions for laying tile in all details? Did you smooth, by sanding or planing, the old floor, and did you use a recommended underlayment? Did you make sure that you were spreading the right amount of cement, not too much or too little, but precisely the amount recommended by the manufacturer of the tile? How old was the cement? Had it always been kept in a tightly closed container? We raise these questions because in so many instances, trouble with tiled floors occurs simply because installation instructions have not been carefully followed. However, instructions cannot always be all-inclusive. For example, failure of a tile floor may be due to some condition peculiar to the room or the structure, or the location of the structure in which the tile have been installed. That's one reason it is not always possible to say with certainty what caused the trouble. In your case, we are inclined to guess that the cause of loose tiles here and there over the floor and particularly in front of the sink—where the floor gets hard service—is simply insufficient cement in the areas affected. If this conclusion is correct then it probably will be best to lift the loose tiles, clear away all old cement, apply new cement under each individual tile and replace, pressing the individual tiles into all-over contact with the subfloor or underlayment.

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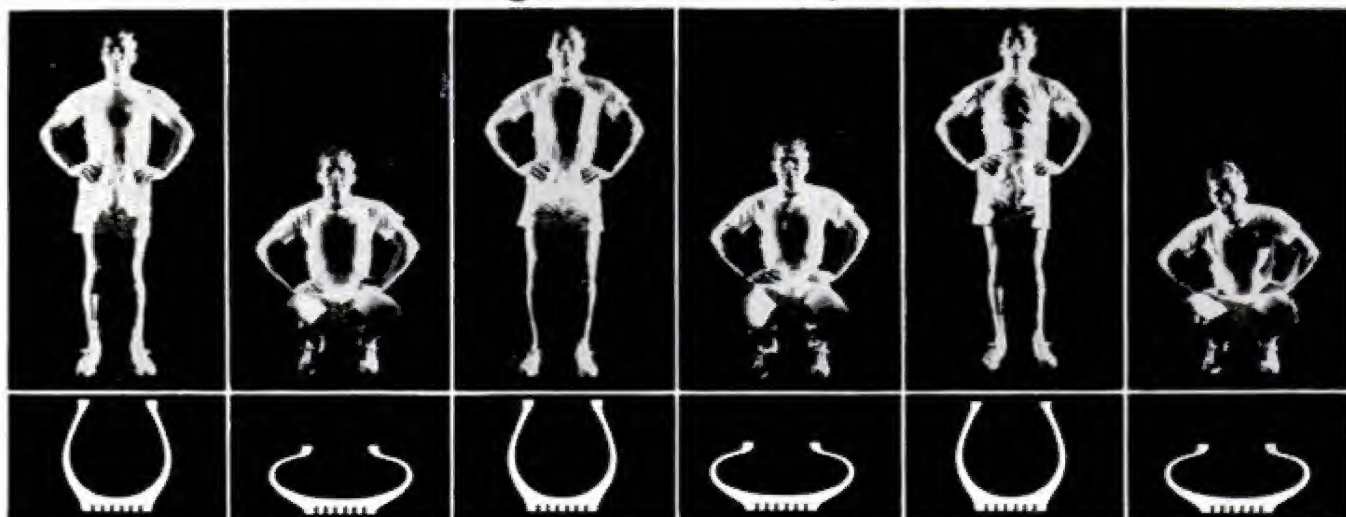


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We're Going to Work Miracles

The atom's power is ready to unlock a treasure chest of arctic oil, dig open an Alaskan harbor, open the spigot for Colorado's shale . . .

By Dr. Edward Teller

WHEN YOU LOOK AT A MAP of Alaska, you will observe Point Hope, at the northwest corner, projecting out into the Arctic Ocean. Above Point Hope the shore is exposed to the polar ice pack—which even in summer is never far offshore. Ships can travel north of this point only one month in twelve.

But below Point Hope, the shore swings to the southeast and the sea is free of ice three months of the year. Nearby are coal deposits and, somewhat farther, oil that might attract commerce except for one vital lack: There is no harbor, no good anchorage for seagoing ships.

If all goes well we expect to make an artificial model harbor on this bleak coast in the spring of 1961. It will be a small harbor, and yet it will be an

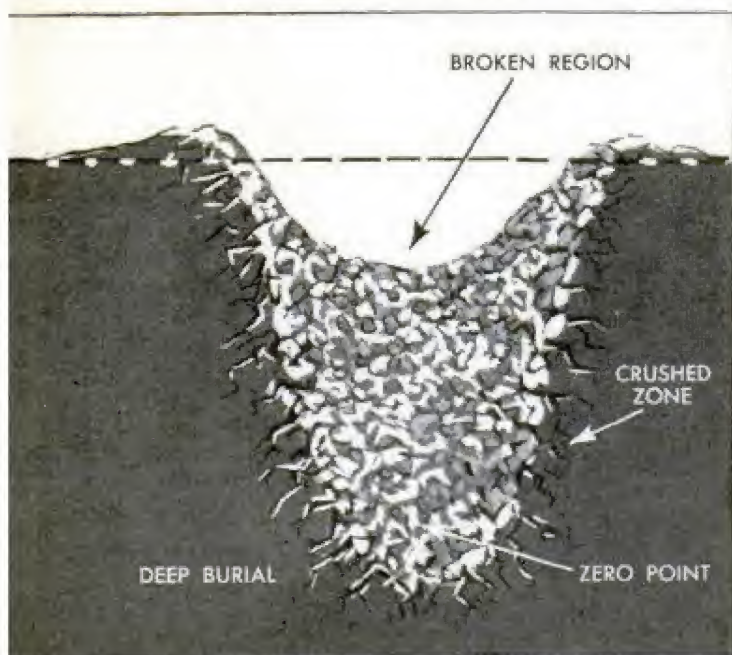
Dr. Edward Teller, "father of the hydrogen bomb," is director of the University of California Radiation Laboratory at Livermore





In a matter of milliseconds, five nuclear bombs will blast open a new harbor in Alaska. The channel will be 1800 feet long and 750 feet wide; the inner harbor, about a half mile long and a quarter mile wide

Deep-buried bombs fling only surface material into air. Radioactive substances stay near the zero point



experiment of great hope for the future. The harbor will be excavated in an instant—in a matter of milliseconds—by the explosion of five nuclear bombs having approximately as much power as 500,000 tons of TNT.

In that tiny interval of time this energy will move 20 million tons of earth and rock. It will blast out a channel 1800 feet long and 750 feet wide and at the same time create an inner harbor a quarter of a mile wide and half a mile long. The minimum water depth will be around 30 feet.

The site is 100 miles north of the Arctic Circle, below Point Hope and Cape Thompson, at the mouth of Ogotoruk Creek.

Project Chariot, as the harbor is called, may become very worthwhile in the years to come, but it is intended mainly as a demonstration that will usher in the age of peaceful uses of atomic explosions. We expect to show that this new kind of power can perform large earth-moving jobs with proper safety and at less cost than conventional methods.

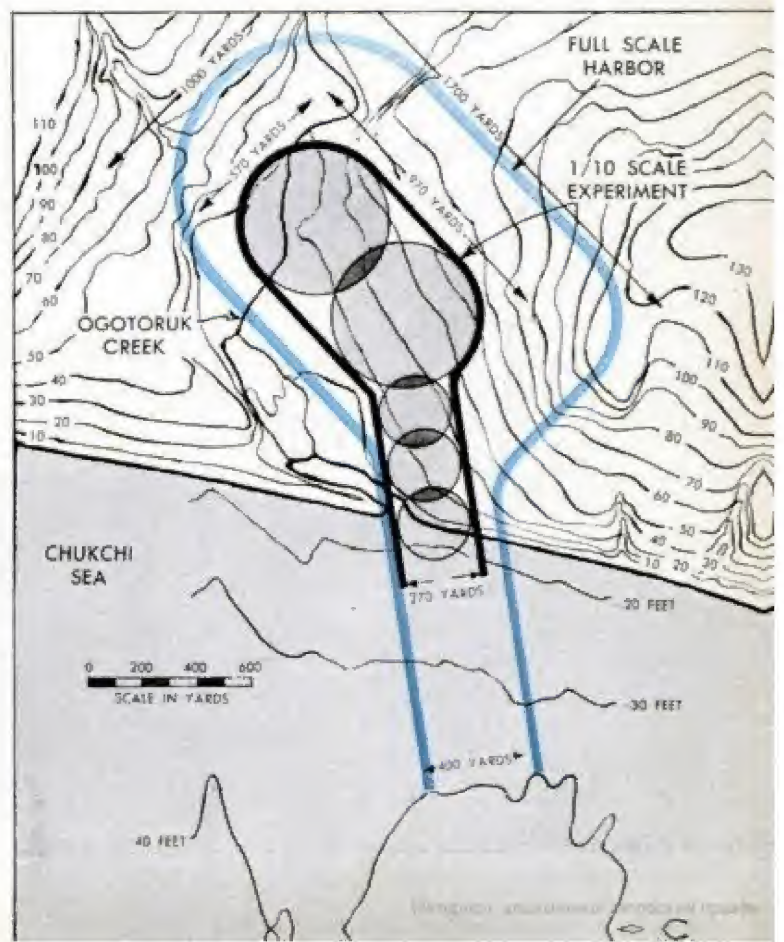


The remote site was chosen deliberately to allay any fears of radioactive contamination. However, there will be very little contamination. To accomplish this, we will use a trick to prevent the possible escape of fission products.

If the nuclear devices were to be exploded at shallow depths, almost all radioactive particles would be thrown up into the atmosphere. So we will bury the bombs deep—about 400 feet below the surface for the small ones and possibly 700 feet for the larger ones. Each blast will transmit its energy to the rock above it, flinging only the surface materials into the air.

We expect that all except 10 or 20 percent of the radioactive byproduct will be trapped at the deep zero points and we hope that it will remain practically immobilized in the fused rock. It is possible that we shall succeed even better and that all but a very small percentage of the radioactivity will be safely contained underground. In a short time, possibly two weeks, it will be

Shading indicates Project Chariot harbor; the blue line shows how harbor can be enlarged, if desired



possible for people to work safely in the immediate vicinity of the explosion.

The mechanics of this are based on several underground test shots that have been made at our Nevada test site. The bombs ranged from one tenth of a kiloton to 23 kilotons in power and were detonated at different depths below the surface. From these experimental shots, we learned a great deal about underground blasts and how much fallout to expect.

Preparations for building the Alaskan harbor are under way now. Last summer 140 people from the Atomic Energy Commission, other government organizations and several universities started surveys in the area. They are studying the geology and making biological surveys of the plant and animal life. They are investigating the food "chains" and the habits of the few local Eskimos, their food sources and their hunting and fishing areas.

Similar surveys will be made at some future date after the creation of the harbor. Thus we will learn whether any local conditions were changed by the blasts. This is indicative of the care and caution with which we are approaching this first large demonstration.

I believe that the dangers from fallout in the weapons-testing program have been greatly exaggerated; nevertheless, this worry exists and so we are trying to develop "clean" bombs. Within a few years,

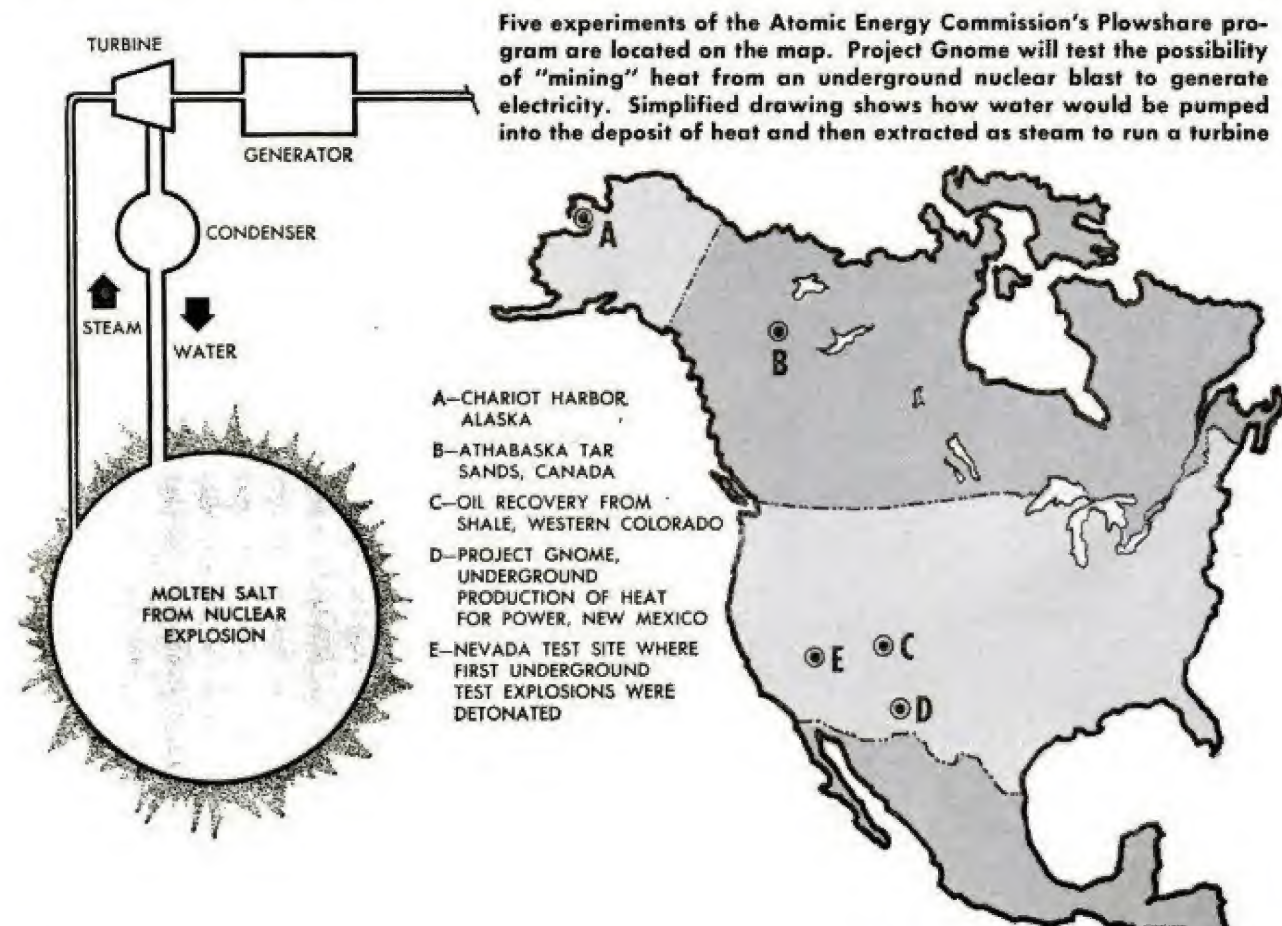
we may be able to produce explosives that are completely clean, with no radioactive fallout and no local residual contamination.

Project Chariot is part of the AEC's Plowshare program for exploring constructive, peaceful uses of nuclear explosives. Studies have been going on for several years and the whole Plowshare subject is now declassified with the exception of the black box that contains the nuclear explosive itself and which we might call Hamlet, as it is the main actor in the drama. Our present necessary secrecy requires that Hamlet shall not appear on the stage for the time being.

If Chariot is successful, we will have the knowledge and experience for creating a harbor wherever one is needed. Its size and shape can be tailored to the local requirements. Several future locations have been considered, as has the possibility of sea-level canals that would be dug in roughly the same fashion as Chariot's entrance channel.

With similar techniques, we can remove the overburden from large bodies of low-grade ore and at the same time shatter the ore so that it can be mined by ordinary means or by one of the suggested leaching processes. Deep ore bodies that are too expensive to mine today may also yield to nuclear mining.

The AEC has established estimated charges for nuclear explosives, including





Project Chariot in Alaska not only will test the possibility of excavating a harbor by nuclear bombs but will also make accessible nearby coal and oil deposits. If needed, the harbor can be expanded to the red line

their emplacement by the commission. Estimates range from a half million dollars for a few-kiloton yield to a million dollars for a megaton bomb. Larger ones would cost only a little more. Future developments may decrease the charges. For the kinds of work we have in mind, we believe the nuclear explosives are cheaper than conventional explosives and in some cases can do work that is quite impractical by any other means.

People talk about putting the cart before the horse, and in this absurd age this is not so unusual; all of us have seen horses carried along in trailers. In a somewhat similar way, we may be able to use nuclear energy to make available more of the old conventional fuel which nuclear energy is supposed to replace. In particular we might use nuclear explosions in oil production.

Why should anyone do that? Because a nuclear reactor emits dangerous radiations and so needs heavy shielding, which makes it clumsy as a motor for a small vehicle. Furthermore, an accident to any moving vehicle driven by a reactor might get us into real trouble. If fission products stored up in the reactor get loose, there will be enough concentrated radioactivity in the neighborhood to constitute a serious hazard. For the purpose of transportation, the light and compact energy package that is gasoline or oil remains better than anything else known or expected. Yet our in-

expensive oil stocks are nearing the point where their decline can be foreseen.

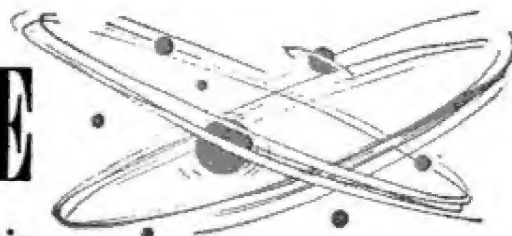
It might be possible to extract more petroleum from deposits that are regarded as depleted by exploding nuclear devices in the formations, shattering the oil sands and perhaps also providing the heat so that the oil may flow more freely.

In the Athabaska River region of northwest Canada there exists a tar sand that contains as much petroleum as all the oil of Arabia. On a hot day the tar drips from the exposed banks, yet no cheap way of extracting it has been found.

A proposal that is being studied by the Canadian Government and the Richfield Oil Company is to explode a 10-kiloton charge at the bottom of a 1200-foot hole in the Athabaska tar sands. From what was learned at the underground test shots in Nevada, we would expect the explosion to create a huge bubble in the earth which almost at once would fill up with shattered rock falling from above. We hope that the radioactive products of the explosion will be trapped in the bubble's glassy lining. If the rock in and above this bubble is sufficiently broken up, and if the material does not get compacted and does not resolidify too rapidly, we have opened a passage for a heating fluid to the tar sands and we can thaw out the petroleum. In fact, the heat of the explosion itself might be used.

(Continued to page 278)

AN EYE ON SPACE



By Dr. Dan Q. Posin

PROFESSOR OF PHYSICS, DE PAUL UNIVERSITY
SCIENTIFIC CONSULTANT AND ADVISOR, COLUMBIA BROADCASTING SYSTEM

NOW THAT WE are getting ready for manned space travel, it would be well to prepare ourselves mentally for what awaits us. It is not too early to think seriously about the other "worlds" in space, because we Earthlings probably will be making personal landings on the Moon in about five years or sooner; and on Mars and Venus within 10 years.

The Moon, because of its relative nearness, will be the first tramping ground. There is no air on the Moon, no water, no vegetation. The Moon clearly is not a prospective paradise, although because of its low gravity, walking, jumping and scrambling around will be a picnic. And, in view of the photographs taken by Lunik 3 of the other side of the Moon, we now know somewhat better what to expect as we walk, jump and scramble over our satellite.

The planet Mars certainly will prove exciting. It has about one-tenth the atmospheric pressure of Earth; there is snow at the Martian poles, and snowfall has been observed in other regions; there is, seemingly, some sort of vegetation and some water. The remote possibility remains that Mars had beings who reached the peak of their culture billions of years ago, and who built great engineering projects. This was the view of the American astronomer, Percival Lowell. And recently, a Russian scientist has suggested that the two small Martian Moons are artificial satellites put up perhaps several billion years ago. In any case, at least some low form of life is expected to be found on Mars.

Venus has become increasingly interesting of late. A balloon sent up by Earthlings not long ago, carrying a large camera-telescope, rose above nearly all of our atmosphere and took some fine pictures of Venus. Upon analysis, these showed that Venus has water vapor. Therefore, Venus may have bodies of water, vegetation and some types of life. A discouraging development, however, is that a new measurement of temperature through a study of radiations from Venus, indicates an average temperature of more than 560 degrees F. When we recall that water boils at 212 degrees F. on Earth, we wonder how life could be present at such a supertemperature. We must not forget, however, that the value of 560 degrees F. is only an average. Tropical values are higher in temperature on Venus, but polar regions may be low enough to permit some life forms to exist.

Other planets are not likely to have life on them. Mercury is barren and has a temperature that rises to more than 770 degrees F. (on the side facing the sun). There is no atmosphere on Mercury. Jupiter has ammonia and marsh gas in its atmosphere. So does Saturn. Uranus, Neptune and Pluto are too far away from the sun, hence too cold to support life as we know it.

But, there are certain bodies that we have neglected for a long time. Some of the Moons of Jupiter and Saturn, despite being cold, may have favorable atmospheres.

If I were leading a program of manned exploration, I'd vote for space ventures in this order: our Moon, Venus (closer to us than Mars), Mars, the Moons of Jupiter, the Moons of Saturn. Ready to buy *your* ticket?

(For a table of information about our Solar System, turn to page 238.)

First of the BIG Small Cars: The COMET



By Arthur R. Railton

IT HAD TO happen. It was inevitable. Just as a Mercury must be bigger than a Ford, so Mercury's compact car must be bigger than Ford's.

The Comet, the new compact car sold by Lincoln-Mercury dealers, is the first of several "big" small cars that will be appearing shortly. Whether all will be "big brothers" of the earlier compacts remains to be seen. Certainly, the Comet is.

Except for sheet metal, it is virtually a carbon copy of the Falcon, sharing most of the Falcon's body shell. It is 14 inches longer over-all. Of these 14 inches, $4\frac{1}{2}$ are in a longer wheelbase (114.0 Comet, 109.5 Falcon), about $1\frac{1}{2}$ inches are in front overhang, and the remaining 8 inches are behind the rear axle in added trunk room. With the exception of trunk space, interior dimensions are identical with the Falcon's (trunk volume is 26.6 cubic feet, almost 3 cubic feet more than the Falcon has). Comet station wagons even share the Falcon's wheelbase.

As you would expect on a car named Comet, it has tailfins. But these are modest, unassuming fins that accentuate the "big-car" look without domineering. Even the I-hate-fins crowd won't object to these. Because of the fins (and a few other styling tricks), this car has a scaled-down big-car look about it. It is just enough longer, just enough more horizontal to eliminate completely the roller-skate look of the Falcon, despite its blood relationship.

Most noticeable part of the car is its roofline which is patterned after the Thunderbird town-car styling. (This roofline is becoming as common to Ford products as the flattop is to GM products.)

Neatly finned, the Comet is stylish. You'll get no small-car reputation with this good looking parked in your big-car neighborhood

There's a lot of Mercury in the Comet's front-end styling. It has dual headlights and even sports gunsights on the fenders





Well-proportioned and roomy are Comet's two station wagons: This four-door, plus a two-door. Both have 109.5-inch wheelbase



Although it is essentially a Falcon shell, the Comet's is not identical. Arrows point to two structural members that are added to floorpan to reinforce the longer body



Instruments are neat and easy to read. The hardware is more substantial, upholstery is richer than in the other new compacts. Below, four-door has a trim profile

All Comet sedans have this distinctive roof. Unlike its little brother, the Comet has the luxury of four headlights set in a concave aluminum grille.

Interiors are beautifully done without any feeling at all of austerity. Once you step inside the Comet the compact-car image evaporates.

Ride is excellent, being quiet, soft and relaxed. Suspension is conventional, high coils in its front independent system (with Falcon's unusual single-strut lower arm), long leaf springs in the rear with normal Hotchkiss. The leaf springs are 50 inches long, 2 inches wide with full-length butyl liners for quietness and dampening.

Steering is unhurried, with plenty of the big-car feel that Dearborn planners are convinced you want (no power options are offered). Over-all ratio is 27 to 1. Turn-circle diameter is 39.3 feet, which is slightly over two feet more than the Valiant's, six inches more than the Falcon's and exactly the same as Corvair's.

Acceleration, too, is unhurried, even by compact-car standards and it's downright crawlish by V8 standards. Even with the 3.56 rear axle, it is unlikely that you'll get to an honest 60 miles per hour in less than 21 seconds. Although no comparison tests have been run by *PM* at this time, it is estimated that economy will be 10 percent less than the Falcon's. Thus, if the Falcon gets 22 miles per gallon around town, the Comet will get about 20.

The engine is, as in the Falcon, a six-cylinder, inline, water-cooled, front-mounted power plant with 144.3-cubic-inch displacement. Horsepower is rated at 90 and compression is 8.7 to 1. Rumors are that the Comet was originally planned with more displacement (the stroke was to be 3.00 inches instead of 2.50, but time ran out and it had to be marketed with the Falcon engine). This 2.50-inch stroke (shared with the Falcon) is the shortest in the industry and should give excellent durability.

Because it weighs about 250 pounds more than



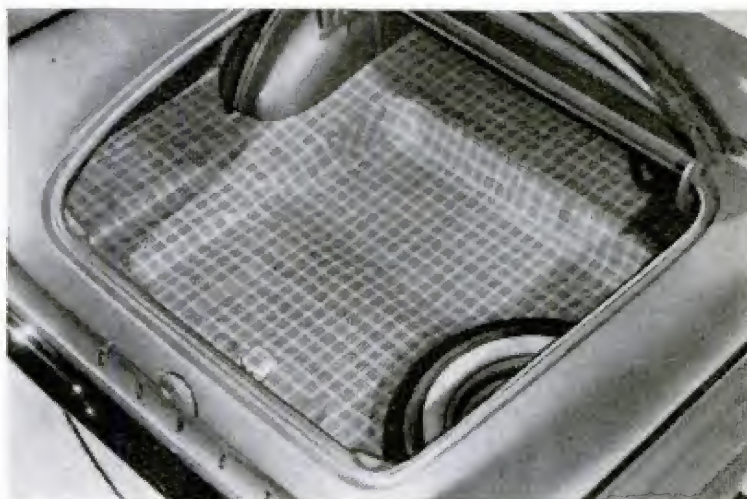
Right, certainly nobody will say that this interior shows any austerity. Below, the trunk space is large although so low that the spare tire is horizontal

the Falcon and yet it has no more power, the Comet is not "hot" by any standard.

But it does look and feel like a full-size automobile. By standards of just a few years ago, it is a full-size automobile. It is, no doubt, the size automobile the Ford-Chevy-Plymouth cars would be if the industry had not lost its sense of proportion.

It is almost identical in over-all size to the 1954 Plymouth. Both have a 114-inch wheelbase, both are 194 inches long (to be precise, the Comet's is 194.9). There has been a reduction in height of course, the Comet being 9.1 inches lower than the 1954 Plymouth. The Comet is narrower also.

But the big difference (here is where the engineer takes credit) is in weight. This new Comet weighs only 2412 pounds, making it 624 pounds lighter than the 1954 Plymouth. This lightness means more economy, less tire wear, better performance per horsepower and a generally more nimble automobile. Yet despite its lightness, it is roomier, handsomer, more comfortable than the low-price cars of only six years ago. Here, then, is added evidence of the return to reason the public demanded—and even more evidence is on the way. ★ ★ ★



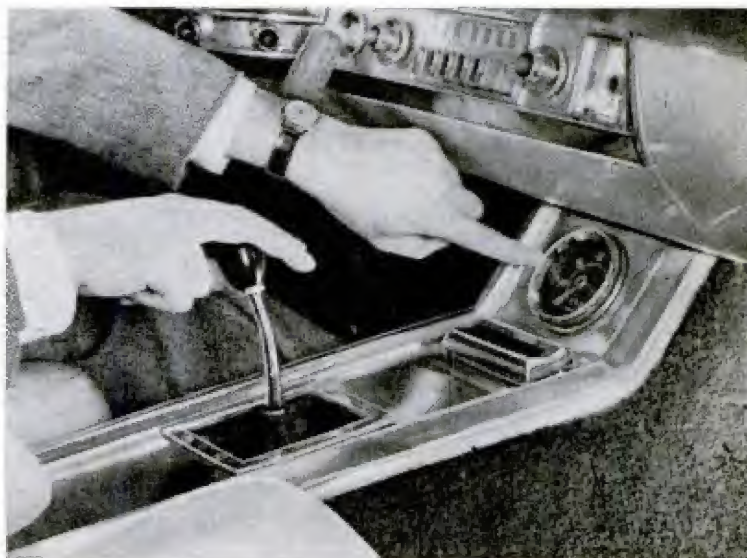
Chrysler 300F

America's only sports-type touring car, the Chrysler 300F, offers a handshift gearbox. The four-speed transmission is an extra-high performance option for competition use. It is the French Pont-a-Mousson fully synchromesh transmission and comes only with a 400-horsepower engine option.

Standard is a 375-horsepower engine and Torque Flite automatic transmission.

The interior has four separate contoured seats with a tachometer-carrying console covering the floor hump.

Right, stubby lever of the four-speed transmission. Finger points to the tachometer. Below, the 300F





Should We Let Nature Take Its Course?

By J. D. Ratcliff

This sugar pine has been attacked by mountain pine beetles (*dendroctonus monticolae*) and its top killed
American Forest Products Industries photo

Left, two Canada geese, trapped in a net, are removed by a biologist so that they can be tagged for study

POSSIBLY YOU SAW these news items:

- A few months ago thousands of pounds of fish poison were dumped in the Deerfield River in Massachusetts. Object: After destruction of trash fish, the stream would be restocked with trout.

- The U.S. Senate recently passed a bill to set up an eradication program for dogfish sharks in Pacific fisheries. Object: Destruction of a pest which each year consumes thousands of tons of food fish.

- Lately, woolly aphids which suck sap of fir trees have been costly pests in Maine forests. To control them the U.S. Forest Service not long ago imported aphid-eating beetles from West Germany.

- Several years back, imported Barbary sheep were stocked in arid western states as a big game animal—with no thought that they would ever increase enough to become a nuisance to farmers and ranchers.

On the surface, all these projects look worthy. But there is growing evidence that they can backfire—and with disastrous consequences.

We like to think of nature as orderly and "balanced." Actually it is as tippy as an overloaded canoe, and man is the great boat rocker. Almost anything can upset the balance—with catastrophic results.

Ecology, one of the least known but most fascinating of the sciences, deals with matters of this kind. It is the study of the complex relationships that exist between living creatures and their environments. No form of life stands entirely alone. Bacteria enrich soil, and worms aerate it so it can produce plants. The plants in turn are consumed by rabbits, and the rabbits by foxes. The foxes die, provide nourishment for soil microbes, and the whole cycle starts again.

Knowingly or not, man must follow the same set of ecological rules that govern destinies of whales, mice and sparrows. Each year these rigid rules assume increasing importance—as a growing population exerts even greater pressure on the available food supply.

Almost anything can tip nature's skittish balance. In 1939 a great windstorm uprooted thousands of spruce trees on Colorado's White River Plateau. Normally, bark beetles are kept under control by woodpeckers. But the birds couldn't get at insects feasting on fallen trees. Result: Beetles, with everything favoring them, increased prodigiously. In numbers which overwhelmed the bird population, they

Skeletons of once mighty trees dramatize the fact that disease and insects kill as much timber as fire

American Forest Products Industries photo





U.S. Fish & Wildlife Service photo

Two-day-old antelope kids shortly after they were tagged at the Sheldon National Antelope Refuge, Calif.



U.S. Department of Agriculture photo

Testing a poison, an entomologist places it on a fire-ant mound; colony will then be examined daily

swarmed forth to attack. In a few days they destroyed 400,000 trees in one check area. In a single mass flight millions of the insects fell into a small lake. Washed ashore, they made a drift six feet wide and a foot deep. By 1951 they had devastated hundreds of square miles of Evergreen forest—destroying five billion feet of lumber worth \$25 million! Then weather intervened to restore a semblance of order. A severe freeze killed the beetle population.

Ecological relationships often have baffling ramifications. Thus New York's St. Patrick's Day parade traces quite directly to a fungus—the one which a century ago destroyed the potato crop in Ireland. The famine that followed launched waves of immigrants to the New World. Charles Darwin related the amount of honey produced in an English village to the number of old

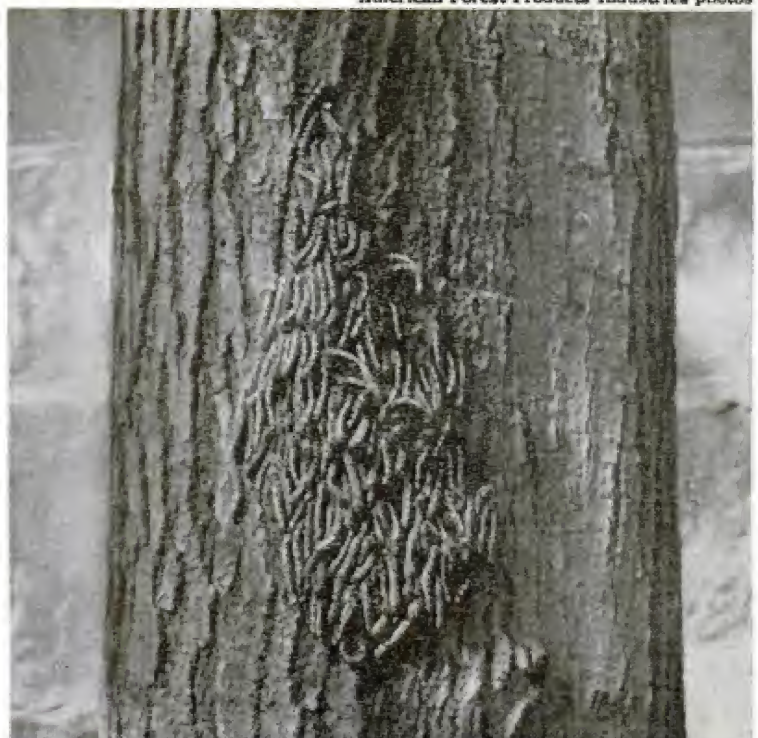
maids! Old maids had cats, cats ate birds and birds ate bees. Thus, a relationship between maiden ladies and honey produced.

There are scores of examples where apparent enemies are friends in disguise. We object to insect "pests"—but without insects, plants would go unpollinated and life would soon vanish from the earth. Farmers complain of the fox that eats an occasional chicken, but foxes earn their keep by subsisting mainly on crop-destroying rodents.

Wild ducks nest in May and skunks and crows feast on their eggs. Bad, we say. But is it? Ecologists aren't so sure. They point out that food and protective cover are sparse during early spring and that newly hatched ducklings would likely be destroyed by predators. When a first clutch of eggs is destroyed, ducks often lay a second—at a later and more favorable date.

Female gypsy moths and their egg masses are clustered at the base of a tree. Gypsy moths, imported from Europe in 1869, have caused millions of dollars in tree damage. At right is an infestation of tent caterpillars

American Forest Products Industries photos





U.S. Department of Agriculture photo

Radiation-sterilized screwworm flies are loaded onto a plane for distribution in an area where the flies are a nuisance. Since a female mates only once, her union with a sterile male ends her productivity

Experience on a western lake offers a good example of the friendly enemy relationship. Sportsmen felt the trout catch would soar if fish-eating otters were destroyed. A program of otter extermination got under way. Instead of increasing, the trout disappeared! An ecologist found the reason. Otters fed mainly on sickly, slow-swimming fish. Thus, they actually aided in maintaining the health of others. With otters gone, sickly fish passed their diseases to healthy ones, and all perished.

A similar situation arose in Ireland's Lough Corrib, one of Galway's most popular sporting lakes. Officials decided to war on coarse fish, hoping to increase the trout population. A slaughter of pike and perch followed. As is so frequently the case, things didn't work out as planned. Trout turned to snails and aquatic insects previ-



U.S. Department of Agriculture photo

Irradiated screwworm-fly pupae are placed in boxes to mature; these pupae grow into sterile adult flies

Portable blacklight insect trap, which collects a variety of species, is used by entomologists in survey work. Animals feeding on one another—as the coyote with rabbit, at right—help maintain nature's balance

U. S. Department of Agriculture and Fish & Wildlife Service photos





In just two months, water hyacinths spread to cover an area of two square miles on the Nile near Khartoum

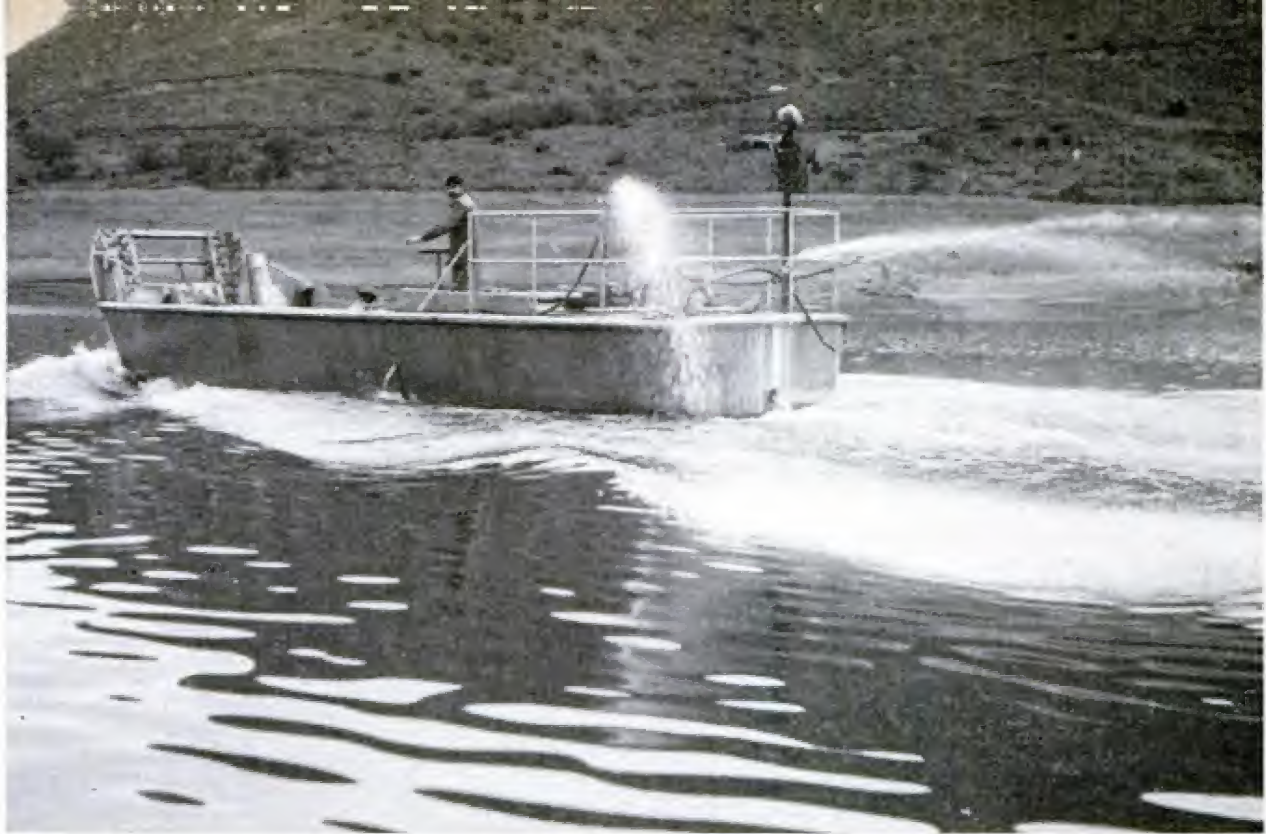
ously consumed by pike and perch. On this diet, they developed worms, sickened and appeared to be dying off.

In Alaska, wildlife officials decided to rid streams of Dolly Varden trout, which consume salmon eggs. A bounty of five cents a tail spurred wholesale destruction. With trout gone, there was an enormous increase in sticklebacks—a small, spiny fish. They developed an even greater appetite for salmon eggs than the trout.

Of all the forces acting to tip nature's scales, man is among the most formidable. Says Clifford C. Presnall of the U.S. Fish and Wildlife Service: "Man is the most efficient, ruthless predator on earth." A case in point is the destruction of 60 million buffalo that once roamed the North American Continent—the greatest big game herd in historic times. Thousands of animals were slaughtered to provide a single table delicacy, buffalo tongues. Repercussions

Sudanese workers, walking on a bed of water hyacinths up to three feet thick, spray to get rid of the plant





Mud-stirring carp were killed and removed from San Diego water reservoir to improve the quality of the water

were enormous. Indians, dependent on buffaloes, faced starvation. The big animals were natural prey for wolves. When they were gone, wolves turned to cattle. Settlers then declared war on wolves and virtually eradicated them. Coyotes moved into this "biological vacuum" and became a major pest in their own right, destroying sheep and other domestic animals. But are coyotes bad? Ecologists think not, since crop-destroying rabbits and field mice have al-

ways been major items of the coyote diet.

Man's obliteration of buffalo was almost complete. He is widely—and unfairly—blamed for total eradication of another species, the passenger pigeon. The last one on earth died in the Cincinnati Zoo in 1914. At one time, this bird was present in almost incomprehensible numbers. In 1804 one flight darkened the sky for several hours. It was estimated to be 240 miles long, one mile

(Continued to page 242)

Five million stunted crappie were killed in Big Bear Lake, Calif., before lake was stocked with rainbow trout

California Department of Fish & Game photos





DETROIT LISTENING POST

By Art Railton

HOW THIN CAN you slice the cake? That's the dilemma of the industry. A few years back the concern was the diminution of models, now it's the multiplication.

Talk about population explosion! Detroit is having a model explosion. New ones are popping up like mushrooms in the rain. Comet is out with a full line, including two wagons. Falcon offers two wagons. Lark added a four-door wagon and convertible this year. American added its four-door sedan and now offers a new Custom line with the overhead-valve six. Corvair adds a two-door coupe and is "testing" public reaction to its Monza GT coupe.

Next year will come the Buick-Olds-Pontiac compacts (all will have the same small V8 engine), Dodge's stretched Valiant, Corvair's buslike station wagon.

How thin can you slice it?

At the moment, all is bullish. Falcons make up 27 percent of total Ford Division sales. When Falcon wagons are out in volume, the percentage will jump sharply (Rambler American, for example, sells 40 percent wagons). Soon Falcon sales will equal big-Ford sales. Soon the tail wags the dog. Valiants already amount to 40 percent of Plymouth production.

The compacts are busting the business wide open. And the not-too-amazing thing is that they don't seem to be hurting imports at all—not even the large-size imports. The compact revolt may have given these imports the air of respectability they needed. No longer is it off-beat for an adult American to want a smaller car—it's becoming fashionable as well as sensible.

Word is that the 1961 Rambler American is more stylish than anything American Motors has done to date. Those who have seen it are goggle-eyed. Gone is its present obesity. It will have modern, forward-looking flat roof, thin doors, straight sides. It retains the same floor pan and length.

It will have the overhead-valve six, which has just been made optional on the present car. With this more efficient engine (same displacement as the old flathead six), power is up so much that a 2.87-to-1 rear

axle can be used, boosting gas economy. This is the ratio used in the Ambassador V8, so no added tooling is required.

Apparently, however, weight is reduced not at all. It will remain the heaviest of the compacts. Perhaps this is good. People seem to like the heavy feel. They have been taught to equate heaviness with quality. Heavy doors sound better, safer, more expensive. Heavy cars are believed to ride better, to hold the road better, to offer more protection. These things are not true, but the public believes they are true.

Next year will be a big styling year at General Motors. The following year, 1962, will be a big engineering year. Thus the ball is bounced from one budget to another, to keep you buying and to keep salesmen happy. Maybe the GM transaxle will have to wait for 1962, although some say '61.

GM has a problem in its distinctive flat roof. Every car from Corvair to Cadillac has it. So much an identification device has it become that you can't see the car for the roof. Noticed how long it takes to decide whether it's a Pontiac or an Oldsmobile? Or Chevrolet? Or Corvair? Well, GM is out to change that. Next year you'll see variety in roof lines. Cadillac is going to the neat, well-tailored roof featured in this year's Eldorado Brougham. Olds 98 will get a distinctive roof, Buick also.

Ford is having roof trouble as well. Too much of a good thing. From Thunderbird down to Comet, it uses the town-car roof (they're even trying to hypo ailing Lincoln with it this year). This, too, will change.

Plymouth is due for some fin-shrinking. What about the argument that fins provide stability? Well, the boys will come up with a new gimmick. Something to do with balance. Whatever it is, you'll be convinced. The industry learned a lot along the wide track.

Poor Buick. After completing the most spectacular performance feat in history it has been told to keep its mouth shut. Remember the pledge? You can't advertise performance. (Word may have leaked before you read this, but maybe not.)

A 1960 Buick covered an unbelievable 10,000 miles in under 5000 minutes—an average of over 120 miles per hour for almost 3½ days! That's running, kids.

It happened at Daytona. Two tries were required. The first Buick was washed out when a gas-line block leaned out the fuel mix, burning up the valves. Nine sets of tires were used. Refueling was done at 120 miles per hour. Only 29 minutes of pit stops were required. The only part that failed was a fan pulley.

Some test, some car! But Buick isn't suppose to talk about it. Let's see how strong the pledge really is!



Army's Helicopter Fires Surface Missiles

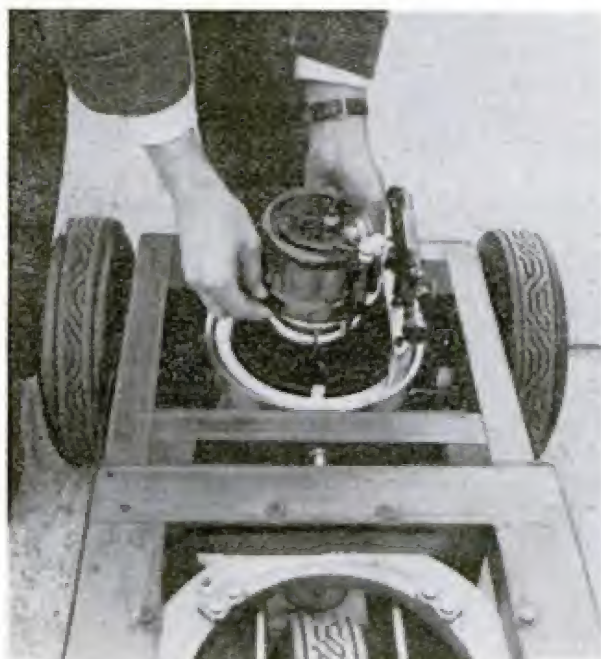
Enemy tanks may hesitate to interfere with the operations of the Army's newest helicopter — it's equipped with surface-to-surface missiles that are fired directly from the whirlybird. A missile rack, extending

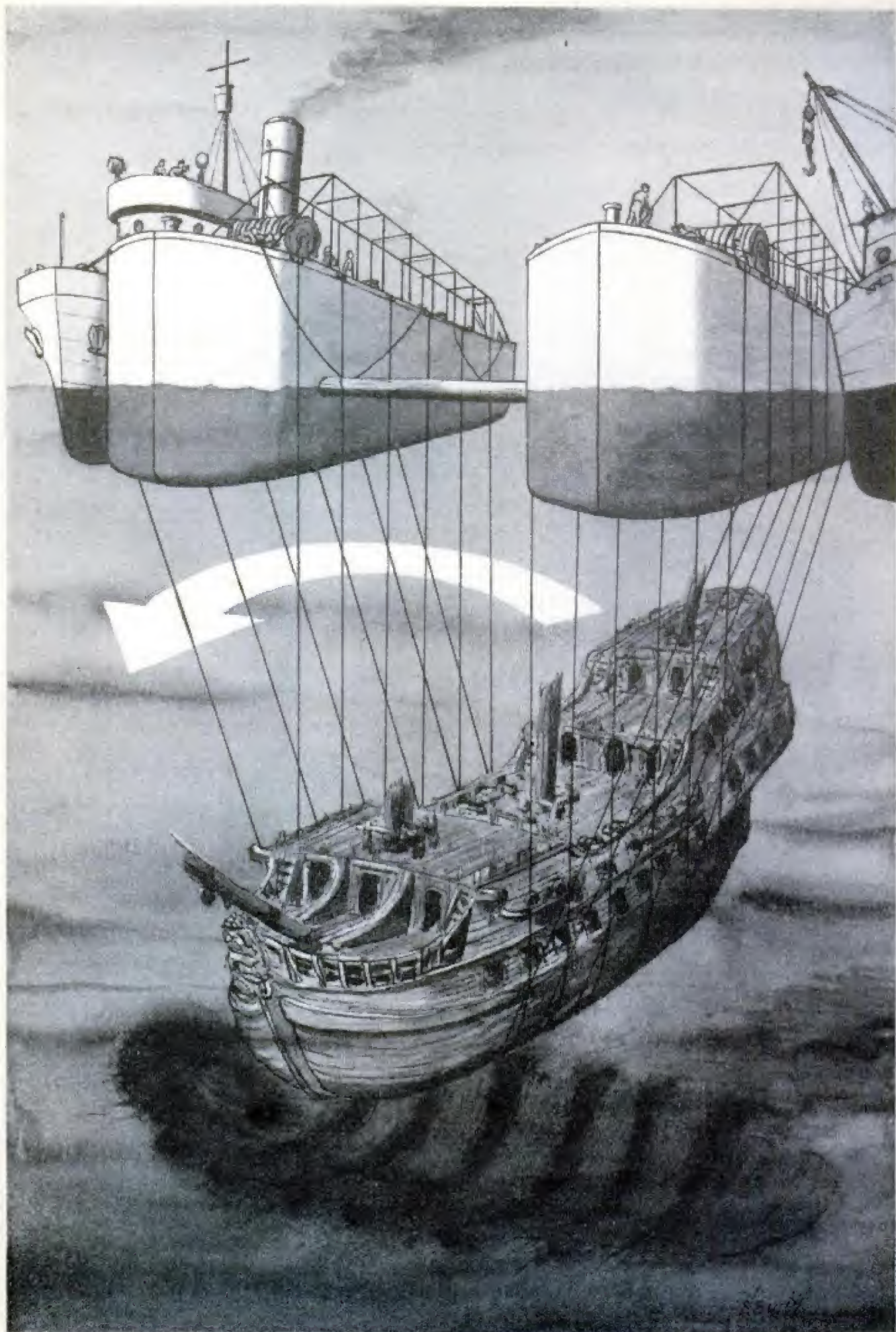
straight out from each side, carries three missiles on either side. It is reported that the missiles, when equipped with an armor-detecting warhead, can knock out any known tracked steel vehicle.

Gravity Meter Detects Hidden Cavities, Pits Beneath Streets

Hidden pits and cavities beneath city streets can now be detected before a dangerous cave-in occurs with a special gravity meter. Riding on a rubber-tire buggy, the instrument consists of a small mass at the end of a spring. When it passes over a

cavity, the mass weighs less and the spring contracts and a gauge registers the difference. Readings are taken every 10 feet along the street. In trial runs it has discovered storm sewers and cavities that otherwise were undetected.





From an American-Swedish News Exchange drawing

Swedish Navy Salvagers Move 17th-Century Ship With Tunnels and Cables

HISTORICALLY IMPORTANT and physically difficult, a naval salvage operation in Stockholm harbor has now gone through its first phase. The Swedish man-of-war *Vasa*, which capsized and sank in the harbor in 1628, has been lifted by giant pontoons and towed, still submerged, a half mile into shallower water. Her equipment, ordnance and ballast are being removed as she rests on the bottom.

The delicate and arduous task of moving the hull—which, with equipment and ballast aboard weighed about 700 tons—involved the digging of six tunnels under the hull. Directed by Commodore Edward Clason, commandant of the Stockholm Navy Yard, divers, working at a depth of 60 feet, carved the tunnels. The divers were handicapped by murky waters which limited the beam of even the most powerful lamp to a mere few feet. When the tunnels were completed, cables were passed through them to enable the pontoons to lift and move the hull.

At first, divers tried to drive heavy nails or clamps into the sides of the *Vasa*, which rested upright on her keel, but after three centuries under water the oak had become as hard as stone and nails would not enter the planks. As a result, the tunnels were made to accommodate the cables.

Already, some 800 objects have been removed from the ship, including several cannon, a hand-carved figurehead of a lion, the ship's rudder and hundreds of ornaments in wood. The stores of the *Vasa* are also expected to yield several barrels of untapped beer.

While the hull was well preserved under layers of mud, some 1000 iron nails in it are now useless. There are, however, about 20,000 wood pegs which are still in good condition.

Eventually the *Vasa* will be placed in a special roof-covered dry dock on public display. She will be completely reconstructed and new pieces substituted for those missing.

The *Vasa*, a 136-foot galleon with a 34-foot beam, was built for the navy of King Gustavus Adolphus. She sank at the outset of her maiden voyage in August, 1628, with an estimated 400 persons aboard. An amateur naval archeologist, Anders Franzen, found the hull in 1956 after carrying on a search for many years.



No Redcaps Need Apply

Travelers arriving or departing at the Central Railway Station in the West German town of Cassel may use, free-of-charge, lightweight baggage carts made of tubular steel mounted on balloon tires to trundle luggage along the platform. The carts rest on their frames for easy loading and are left standing, after use, for other travelers.

Blast of Horn Changes Slides

High-frequency sound from two small hand-held horns will not only change slides in a new slide projector but will change the focus of the lens to compensate for transparencies that may "pop" in their mounts. The horns, whose sound frequency is inaudible, may be as far as 100 feet or more from the projector and still actuate it. The sound-receiving unit is housed in a metal cylinder attached to the projector. The projector may be converted from sound-actuated automatic operation to manual operation by a switch.



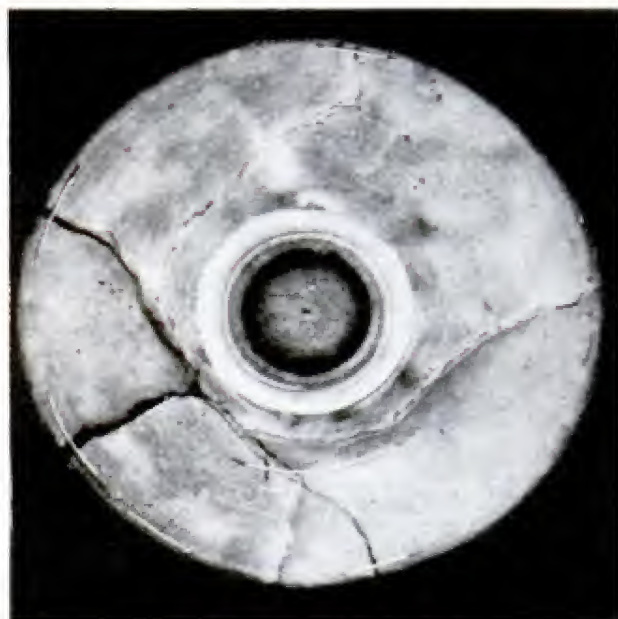


Dr. Herbert Pollack points to an area of ink that would not show on an X ray, if this stamp were a forgery

X-Ray Detectives

Two scientists make a hobby of peering into mysteries, ancient and modern, with the X-ray camera

X ray shows nearly 40 percent of a Persian bowl was restored and its sections pieced together with wires



Photos courtesy of Memorial Art Gallery, Rochester, N.Y.



Photo courtesy of The Brooklyn Museum

Two Madonnas and child on the same piece of wood. X ray disclosed a faker had forged one atop the other

THE "X" in X ray stands, as in algebra, for something unknown. A two-man team of scientific investigators, however, are proving that pictures made with X rays can make a great contribution to the world's store of knowledge. Using the X-ray camera—much as Sherlock Holmes used the magnifying glass—they are turning up clues to all sorts of mysteries in the fields of science, art and industry.

The X-ray detectives are Charles F. Bridgman, of Rochester, N.Y., and Dr. Herbert C. Pollack, of Chicago. Since they started sleuthing together, in 1952, they've been providing graphic answers to such tough questions as these:

- How honest was an Egyptian who practiced embalming 5000 years ago?
- Did someone break a 16th century Persian bowl before it was bought by an upstate New York art gallery?
- Is a seemingly rare and valuable postage stamp worth the paper it's printed on?
- Did Indians whose bones are buried in mounds in Illinois have diseases of modern man?

X rays—discovered and named in 1895 by Wilhelm Konrad Roentgen, professor of

physics at the University of Würzburg, Germany—today are familiarly used in medicine and industry to locate broken bones and to determine the soundness of castings and welds. But the interests, training and skills of the X-ray detectives have led them to turn the rays to more unusual investigations.

The Men, the Ray

Bridgman studied fine arts and sciences at Colgate University and is associate editor of a medical photography magazine published by Eastman Kodak Company. Pollack has practiced clinical roentgenology (the science of using X rays) in Chicago since 1940, and, along with others, has acted as X-ray consultant to the Chicago Art Institute. The two met at a Chicago stamp-club meeting, where Bridgman demonstrated how stamp forgeries can be detected by X ray. He found a kindred spirit in Pollack, who had conducted similar experiments as early as 1928. Their nonmedical research in the past few years has resulted in two exhibits of X-ray photographs (radiographs) of ceramics, fossils and insect specimens, and of art and stamp forgeries, which they regularly loan to museums throughout the world.

X ray had quite a humble beginning as an investigative tool. Roentgen discovered that under certain conditions a small

Editor's Note: Because of their regular work and previous commitments, Pollack and Bridgman will not accept additional material for X-ray examination.

vacuum tube emitted an invisible ray that penetrated opaque objects and would leave a shadow picture of what was inside on a photographic plate. He called the ray "X" because it was new to him. (We now know, of course, that X rays are part of the electromagnetic spectrum and thus are related to radio waves, heat or infrared rays, and visible light waves, among others.) Even though Roentgen knew little about the rays, he established some famous firsts with their use. The radiograph he made of his wife's hand heralded the science of medical radiography; his X-ray pictures of factory-made objects—a shotgun and shells, for example—presaged their role in industrial radiography: Today, pipelines carrying oil cross-country are X rayed at the seams to insure against leakage. Tank cars get the same treatment. High-speed radiographs have even been used to analyze the action of a bullet shattering a row of light bulbs.

X rays make a better detection tool than Sherlock Holmes could ever have dreamed existed because they allow investigators to peer into an object without first tearing it apart.

Solving Ancient Mysteries

Working with X-ray cameras like those found in many doctors' offices, Bridgman and Pollack have learned a lot about such things as mummies that, if unwrapped, might be destroyed. One such investigation even exposed an ancient Egyptian embalmer as being dishonest. When an Egyptian died 5000 years ago, it was customary to kill, embalm and bury his household pets with him. A mummy of one of these, a baby crocodile, was examined by Bridgman. On the outside, the wrappings looked as if they were wound about a body. A radiograph, though, showed the embalmer had been a trickster. He'd substituted a rolled-up piece of cloth. It's not unusual for them to X-ray an eight-foot-high painting or an entire Egyptian mummy case. Often several sheets of film are used for this type of work. However, for one look at the skeleton of a mummy swathed in wrappings, a single piece of film two by seven feet was employed.

X ray also helps solve another mystery created in ancient times. Long ago, Assyrians wrote letters on clay tablets, baked them, then built a clay envelope around them. The address, and information about the letter, were placed on the outside. Without breaking the envelope, how do scholars know whether they have a letter or an envelope with a message inside?

They make radiographs, which distinctly show the outline of an inner tablet.

This nondestructive quality of X ray as an investigative tool allows Bridgman and Pollack to detect hidden paintings on old canvases and find damage and repairs inside pieces of pottery, although they point out that they are not art experts; they leave interpretation of radiographs to art conservators, who also may use chemical analysis, infrared photography and microscopy to learn more about a work of art. In detecting forgeries and fakes, knowledge of the techniques and materials used by the original artists and their followers is invaluable. Chemical analysis of a fragment of pigment can prove whether the paint on a questioned canvas is the same type a famous artist is known to have employed in works that have been conclusively authenticated. Details of brushwork may also be compared with the help of pictures taken through a microscope or on infrared film.

"With X ray, we don't discover so much as we vindicate," they say. "Someone has an idea that something is wrong. One of the best ways to prove or disprove this is through X ray."

Recently, they vindicated the fears of curators of a Rochester, N.Y., art gallery, who suspected that a 16th-century Persian bowl had twice been broken and repaired, because one section glowed more milky-white than the rest. Not until the bowl had been radiographed did the owners learn that more than one-third had been replaced with new clay, that wires helped hold the sections together.

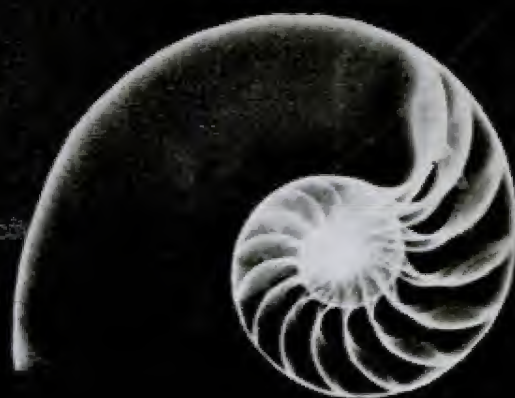
The bowl was an example of expert restoration, but the detectives have proved that other art objects were out-and-out fakes. One of the most skillfully executed was a Renaissance Madonna painting from northern Italy. X ray disclosed that the faker had taken an old panel of wood with a Madonna already on it and painted a new picture over it. The picture, as illustrated, differed in many details. The faker had been thorough, though. He made crack lines on the new picture with a needle to give it the appearance of age.

Detecting Counterfeits

Because Bridgman and Pollack share a strong interest in stamps, they have used X rays to gain insight into the attitudes and procedures of stamp counterfeiters. Bridgman's work in this field has taken him abroad, to crime laboratories in major cities, and to association with Treasury Department investigators in Washington, D.C.

X rays show the inside story. At top right, photo and radiograph of nautilus shell; center, radiographs of a mummy and beetle; bottom, two views of a Cecropia moth: its hollow veins harden into struts for wings

Moth photos courtesy of H. Lou Gibson and Harold Sherwood



One of the major flaws in most counterfeits can be detected easily by X ray: Many classic issues were printed with metallic inks, whereas most fakes are made with aniline-base inks. Metallic elements in the original inks are dense enough to hold back X rays, so the stamp's design shows on the sheet of radiographic film. Counterfeiters seldom simulate the rare issues any more because the high-value items would be subject to close scrutiny by experts. Pollack says, as a result, that many fakes in circulation are among stamps of small worth. "The market is flooded with imitations of stamps worth about 50 cents." These are not subject to X-ray analysis, which might cost \$10 or even more.

The investigators use three methods of radiography in examining stamps.

To reveal the design of a stamp, or its cancellation, as traced by metallic inks, they use low-voltage radiography, in

which radiation as low as 6000 volts is employed.

To gain a general knowledge of the chemical types of ink used, they use electronemission radiography. Electrons made by X rays, rather than the X rays themselves, trace the image on film. When irradiated with X rays of a suitable wavelength, the metal elements in the ink emit electrons. The quantity of the emission depends on the atomic numbers of the elements present in the inks and paper. Such X rays often show the details of the design of the inks in the stamp and leads to a general knowledge of the chemical types of ink used. These data allow comparisons of an original and a suspected forgery.

To show details of paper structure and watermark without the image of the design or cancellation, the technique of X-ray electronography is employed: Lead is placed in contact with the stamp and

Dr. Pollack uses X-ray machine like those in doctors' offices to make a radiograph. Bowl rests on film





Radiograph of Austrian stamp shows center was removed and inverted. The adhesive used makes dark lines

made to emit electrons. The electron emission is sufficient to penetrate the stamp to the film. Electron emission from metallic ink in the stamp is usually slight, compared to emission from lead; therefore, the ink design is seldom seen. The X rays etch on film the fine details of paper structure and watermark. The technique is useful for showing repairs of damaged or torn stamps. In order to make X rays of stamps, incidentally, Pollack cautions that an individual should first have permission of the Treasury Department.

Fossils, Moths, Beauty

The team has also turned its machines on samples of rock brought up by oil-company drillers to reveal the type of rock structure and fossils at specific points beneath the earth. Analyzing this information, geologists gain clues as to whether oil will be found at a particular site, and how far down. Bones and skulls found in Illinois Indian mounds also gave up information to the X-ray camera. X-ray examination indicated that the Indians were prey to osteomyelitis and bone cancer, as well as other ills of modern man.

An X-ray analysis of a species of large moth was another of the team's contributions to basic science. They showed that ribs of the moth's wings were in reality hollow structures, which the insect filled with body fluid soon after it came out of its cocoon. When the fluid hardened, the moth had wing support for flight.



To the trained eyes of these collaborators, X-ray pictures reveal a hundred hidden truths.

They can also be objects of beauty, and the men search out such subjects to X ray. Fossils found on weekend walks to quarries and mines, some of the insects and corals—these subjects, when X rayed, produce pictures with beautiful composition and tracery of lines seldom attained by artists.

One picture of delicateness and whorled beauty is an X ray Bridgman and Pollack made of the chambered nautilus, which lives and moves silently through the ocean. They were not alone in appreciating its beauty, either. A print of it was hung in the wardroom, for the enjoyment of the crew, of another undersea explorer, the atomic submarine *Nautilus*. ★ ★ ★



Dr. Kramer holds a sample of the hydraulic skin, inside upward, to show the tiny studs and space for the damping liquid that may speed submarines



Testing the membrane. A model underwater vehicle is towed by the test boat while sensitive instruments record the comparative frictional drag

Unusual "sandwich" outboard motor arrangement drives the test boat at high speeds. Hooded operator reads instruments and makes test notes



Rubber-Clad Submarines Ahead

BORROWING the secret of the porpoise's effortless swimming speed, a Los Angeles scientist has developed a rubber "hydraulic skin" that reduces the drag of a liquid along a solid surface so effectively that it suggests we may see submarines capable of 70 miles an hour and, with improvements in power, underwater objects that can travel up to 180 knots (207 miles an hour). Dr. Max O. Kramer, vice president of Coleman-Kramer, Inc., Los Angeles, studied porpoises to find out how they can swim with such flashing speed and so little effort. His calculations showed that some factor was cutting the drag of water along their bodies by 90 percent. Working at Marineland of the Pacific at Palos Verdes, Calif., he discovered that the porpoise has a $\frac{1}{16}$ -inch hydraulic skin which damps out turbulence, eliminating much of the drag. After many experiments, the rubber membrane at left above was developed. About $\frac{1}{8}$ -inch thick and covered on one side with tiny studs, it is stretched around an object with the studs on the inside and the space between the studs is filled with a damping fluid. Frictional drag has been reduced up to 60 percent in some tests; further refinements may raise that figure to 90 percent. Use of the skin may cause dramatic changes in water transportation, both on underwater and surface craft, and even in pipelines, where the same principles apply. The United States Rubber Company is planning its manufacture under the trade name "Lamiflo."



Loader Separates Operator From Shovel

Complete separation of the operator's compartment from the shovel is featured on the "new look" front-end loader of Caterpillar Tractor Company. Called "Traxcavator," the machine has a loader located ahead of the operator, which eliminates danger from lift arms and cylinders passing by the operator. A max-

imum dumping height of nine feet makes it easy to dump to the center of high-sided trucks. The bucket capacity is two cubic yards. Standard on the tractor are the hydraulic bucket positioner and lift kickout. In addition to a power shift transmission, a manual selector provides four-wheel and two-wheel drive ranges.

Bicycle Built for Family

Bolted between two standard two-wheel bicycles, a tubular metal carrier enables the cyclists to carry one or two children plus enough luggage for a short camping trip. Manufactured in Germany, the device includes a bar that joins the steering columns so they move in unison.



Jet Plane Gets Roller Skate

When Lt. Col. Dwain Lengel, commander of Marine Fighter Squadron 323, saw that tails of F8U-1 *Crusaders* were sometimes banged up in landings, he had a roller skate attached to the tail of one. Although a joke, it worked so well that he's considering skates for all his jets.



OWNERS
REPORT

A NATIONWIDE SURVEY

BASED ON 1,190,084
OWNER-DRIVEN MILES

Easy to steer and park, the Corvair is a real pleasure car. It hugs the road and loves corners, say owners

Corvair Is Exciting to Drive, But

MARGINAL COMMENTS
BY ART RAILTON
PM's AUTO EDITOR

Only a professor
could be philosophical
to this extent. →

Let's hope that the
"bugs" in this all-new
design won't make Chevy
(and others) revert to
standpattishness. →

HOW DO THEY like it? How pleased are the Corvair pioneers? Is this all-new car the answer to the motorist's prayer?

To find out, PM surveyed hundreds of Corvair owners from coast-to-coast. These owners had driven their new Corvairs over a million miles at the time of the survey. Here, then, is their story.

What about Chevrolet's boldness? It's easiest to take the well-traveled path, but is it best? The owners, generally, are pleased and like this new Detroit daring.

"Considering the conservatism of Detroit, the Corvair is well nigh a miracle. Chevy's courage in making a complete break with the past and turning out a car with a rear-positioned aluminum engine, smart appearance, and superb suspension has really paid off—and I write this owning a lemon that is so lemony as to be amusing. But I think the Corvair is a magnificent car."—Ohio professor.

"The Corvair will in time set the pace for the small car in the U.S.A. Chevrolet is a pioneer in a previously taboo field with its rear-engine economy auto."—Maryland machinist.

"I think this is the greatest thing to happen to American cars since the beginning."—Florida computer operator.

"This new Corvair is like a wife. You love her and wouldn't part with her for anything, but there are a number of aggra-

HOW GOOD IS THE CORVAIR?

Owners like:

Handling ease	69.7%
Riding comfort	36.8%
Exterior styling	21.9%

Why did they pick Corvair?

Economy of operation.....	50.3%
Engineering features	49.5%
Exterior styling	44.1%

WHAT'S WRONG WITH IT?

Owners dislike:

Poor gas mileage.....	25.6%
Heater operation	15.5%
Stalling, carburetor	13.5%

What should be changed?

Increase gas economy....	10.5%
Improve heater	6.5%
Make better seats.....	4.3%

WILL THE CORVAIR CUT INTO IMPORTED-CAR SALES?

YES say 81%

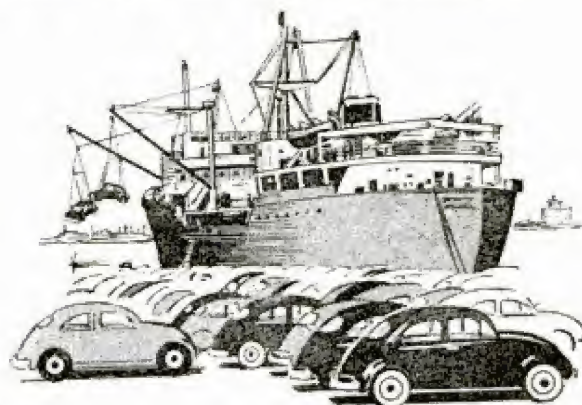
NO say 19%

Corvair has:

Better service
More room
U.S. styling

Imports have:

Lower price
More economy
Better quality



Needs More Economy, say Owners

vating defects that spoil the charm."—Wisconsin engineer.

"I have never had as much attention as I have gotten since I bought this Corvair. Men are especially interested (I mean in the car). They ask questions and look it over from top to bottom."—Ohio nurse.

As with any all-new car (and there never has been an American car that was as all-new as this 1960 Corvair), there have been troubles. And these owners are frank to discuss them. But there has been no trouble at all about suspension. The Corvair has handling characteristics that the owners rave about. Nowhere is there mention of instability.

The best-liked feature is handling and steering ease with 69.7 percent mentioning it.

"After driving a Corvair a standard-size car handles like a dump truck."—Ohio sales administrator.

"All those adverse claims of Corvair's competitors about the so-called undesirable rear engine is not true. It handles, takes curves and corners (wet or dry) better than any car I have driven in 20 years."—Rhode Island executive secretary.

"It's a car that is a pleasure to drive in the city or on any road. I like the Corvair more every time I drive it."—Ohio plant manager.

Second on the list of best-liked features is riding comfort with 36.8 percent mentioning it.

← *Here's what Detroit needed—something fresh, new, something other than fins to make people proud.*

← *Where's the guy who used to shoot arrows? Now that the public can play the game, he ran off with his bow!*

← *Here is its greatest charm—its pleasant manner on the road. It is giving America a new yardstick in handling.*



Owners also praise its riding comfort. The four-wheel independent suspension flattens out railroad crossings



They love the rear engine. None say it should be up front. All like its traction on ice or snow

Four-wheel independent suspension pays off on rough stuff. →

A meat cutter should know a clean cut when he sees one! →

Economy is not so good as the public expects. PM ran a test on a stickshift Corvair (one with all production "fixes" on it) and got the following: Turn-pike driving (60 mph average) 21.9 miles per gallon; rural-road driving (50 mph average) 20.9 miles per gallon; city driving (never over 30 mph) 16.2 miles per gallon. Air temperature 32 degrees, heater operating. On one separate test with heater off (never over 60 mph) 22.5 miles per gallon. →

"I like the quiet, peaceful, comfortable ride it gives. With the engine in the back, engine noise is reduced even more."—Rhode Island machinist.

"I live at Cape Hatteras and roads are rough. This car takes the ruts better than my 1957 De Soto did."—North Carolina retired sailor.

"It doesn't bounce you as most small cars do."—Ohio paper inspector.

Third best-liked feature is styling, with 21.9 percent mentioning it.

"I like the fact that it is uncluttered and easy to wash."—Wisconsin nurse.

"Clean-cut body design."—North Carolina meat cutter.

And Now the Complaints

But all is not perfect. These Corvair owners have reason to complain—and they do it. Leading the complaint list by a wide margin (with 25.6 percent mentioning it) is inadequate fuel economy. They are not getting the mileage they expected.

"My only gripe is gas mileage. For 3077 miles of driving I averaged 16.3 miles per gallon. About 10 percent was start-and-stop travel, about 40 percent was short trips, the remaining 50 percent was trips of over 100 miles. Gasoline costs have averaged 2.1 cents per mile. I have an automatic transmission."—North Dakota county agent.

"I average 18 miles per gallon in city, 20 on long trips. I have automatic transmission. I was hoping to get at least 25, but the dealer now tells me that he doubts if I'll ever get over 20."—Ohio engineering service representative.

"I am averaging 15.9 miles per gallon over-all with automatic transmission. The dealer couldn't bring the city mileage up over 14 so I wrote GM. Their representative, Mr. Horst, checked the car out and got 28 miles per gallon at 40 miles per hour with a tailwind. I wish I had him for a chauffeur."—North Dakota salesman.

"The service manager drove this car a total of 31.2 miles at a speed of 35 miles per hour. There was only one traffic light in the distance. The gas consumed was 1.3 gallons. I cannot see how this is an economy car if I must keep below 35 miles per hour to get economy."—Maryland electrician.

Second on the complaint list is the gasoline heater. This item also appeared on the best-liked list. Apparently, if the heater works well, it is great, but when it doesn't work it's



Women can't reach the headlight dimmer switch without lifting the foot, a tiresome chore if continuous



It is not easy to get in and out. Stepdown floor, low roof make entry and exit an art to be learned

a major complaint. It didn't work right for 15.5 percent of the owners.

"I would like better heater controls. It is either off or on. You do not seem to have various degrees to suit the demand at the time."—Wisconsin arc welder.

"Heater noise ruins otherwise soundproof effect of this car. Heater controls too stiff in cold weather and it uses too much gas for the amount of heat that it produces."—South Dakota salesman.

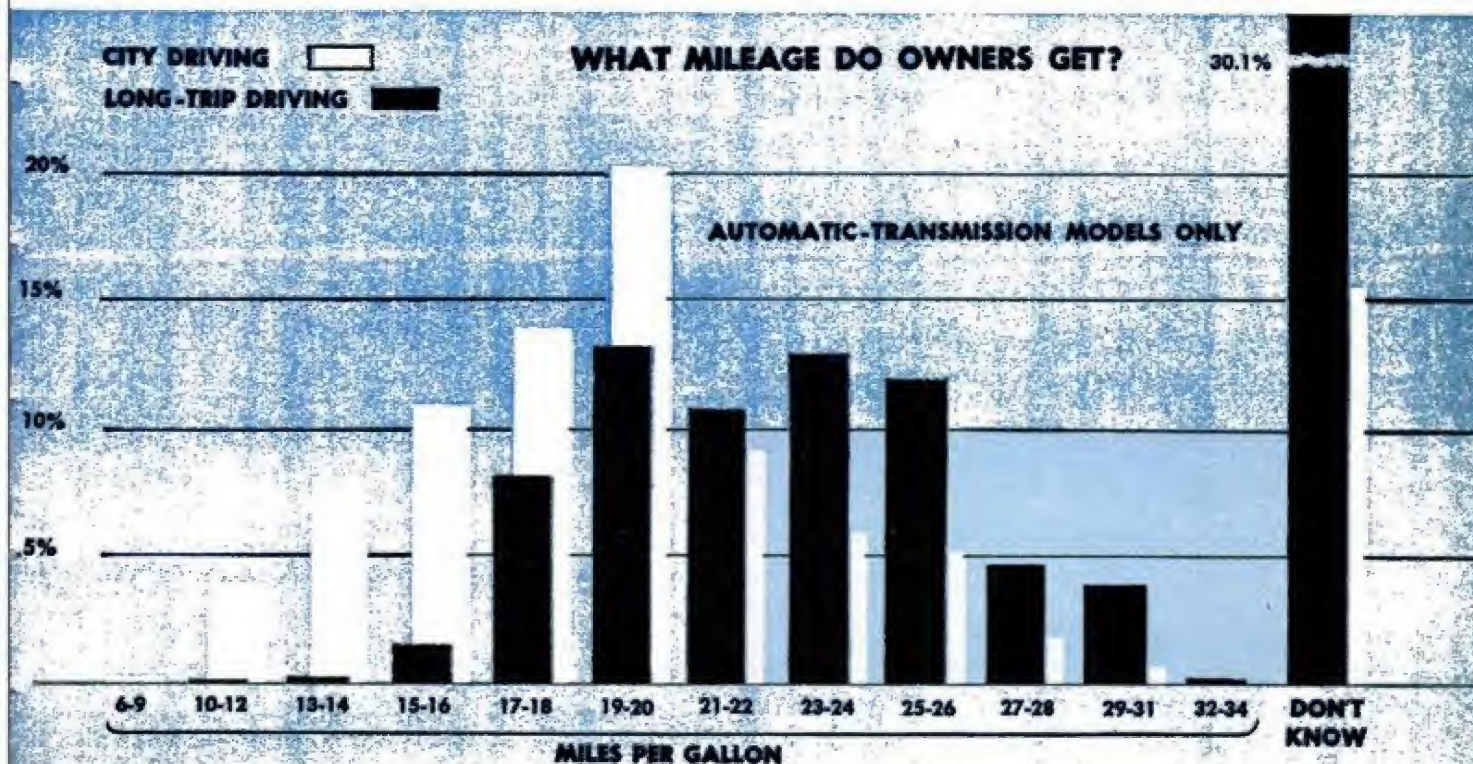
"Heater seems to heat only the middle of the front seat."—West Virginia construction foreman.

Third on the list of complaints is the problem of carburetor icing. Chevrolet made a "fix" on this during the steel-strike shutdown so current production should not have this fault. Cars in the field are being modified by dealers to correct the trouble also. However, some owners (13.5 percent of the total) had trouble—and plenty of it.

← **Heater failed on test car and brrrrrrrr! With no engine heat in front, it's a cold car. When new points were installed, heater worked perfectly thereafter. Production change has quieted heaters on current Corvairs.**

← **Sure, they test new designs under all weather conditions! Who are they kidding?**

Most automatic-transmission owners say they get 17 to 20 miles per gallon in city, 19 to 26 on long trips





Despite a slow steering ratio, it is a fun car for the family

Wonder if he sells Danish furniture? Or maybe imitations? →

He's right. Detroit didn't jump into the fight—yet. But wait, the bantam-weights will be along later. →

"There appears to be an inherent defect in the carburetors. They ice up at certain temperatures and humidities. You can see frost on them. On a recent 100-mile trip the engine just lost power going up a hill 50 miles from home at 3 a.m. and finally stalled. I could not restart it until the car had stood for about five minutes then it ran fine for 20 miles and stalled out again. In a few minutes, okay, then stalled again."

—Rhode Island physician.

"Why has a car that went through tests at 20 below zero developed carburetor icing problems?"—Virginia Marine helicopter crew chief.

"Carburetor icing, but company is supplying a kit to eliminate it."—Wisconsin newspaper publisher.

What About the Imports?

Will the three new compact cars cut into sales of imported cars? Corvair owners think they will, at least 81 percent of them do. Another 19 percent think not, however. Here are some quotations:

"Corvair is bigger, better looking, more powerful than foreign cars in same price range, yet still sensible. I have owned a VW."—Maryland federal analyst.

"I am against purchasing foreign products. It hampers our employment and parts are not always available."—Ohio furniture dealer.

"Corvair will not cut into foreign sales. If one has made up his mind to buy a foreign car, he will not take a substitute. I know!"—Tennessee architect.

"It won't hurt foreign-car sales. It is not as economical as one."—Ohio stenographer.

"Corvair is a different class of car. VWs are not readily available anyway."—West Virginia coal mine superintendent.

"If we improve our labor practices, increase the quality, the Corvair will replace all except the exotic foreign types."—Tennessee securities man.

(Continued to page 272)

SUMMARY OF OWNERS REPORT:

CORVAIR



What about gas mileage?	
Satisfied with it.....	50.8%
Not satisfied	45.4%
No answer	3.8%
Best-liked features	
Handling ease	69.7%
Riding comfort	36.8%
Exterior styling	21.9%
Traction on ice, snow	21.5%
Ease of parking	20.6%
Roadability	19.8%
Most-frequent complaints	
None at all	20.0%
Poor gas economy	25.6%
Heater operation	15.5%
Stalling, carburetor	13.5%
Hard to get in, out	8.4%
Trunk size, shape	7.1%
Had engine trouble?	
No trouble at all	64.5%
Some trouble	27.5%
Considerable trouble	8.0%
What was trouble?	
Carburetor, stalling	17.0%
Fan belt trouble	3.9%
Automatic choke	2.6%
What one thing should be changed?	
Nothing or no answer	31.2%
Improve gas economy	10.5%
Gasoline heater	6.5%
Trunk space	4.3%
Why did they pick Corvair?	
Expected gas economy	50.3%

Liked engineering	49.5%
Exterior appealing	44.1%
Over-all size	43.4%
Initial price	8.8%
What like best in styling?	
Simplicity	44.3%
Large glass area	10.5%
Lowness	7.1%
What like least in styling?	
Lack of front grille	6.0%
Bumper design	5.4%
Rear-end design	3.7%
What like best inside?	
Lack of floor hump	27.3%
Roominess	17.0%
Fold-down rear seat	11.8%
What like least inside?	
Seat comfort, quality	6.0%
Drabness, austerity	5.4%
Lack of arm rests	3.7%
How is dealer service?	
Excellent	55.5%
Average	31.4%
Poor	13.1%
Would buy from him again?	
Yes, would	60.2%
No, would not	13.8%
Don't know, no answer	26.0%
What make was traded?	
Chevrolet	34.6%
Another GM make	11.4%
Ford Motor make	14.4%

Chrysler Corp. make	8.1%
Other U.S. make	5.7%
Foreign make	6.5%
No trade, no answer	19.3%
What make will buy next?	
Another Corvair	31.0%
Big Chevrolet	9.2%
Another GM make	4.7%
Foreign make	2.1%
Chrysler make	1.3%
Ford make	1.1%
American Motors make	1.1%
Undecided	49.9%
Large enough for "family" car?	
Yes, it is	73.7%
No, it is not	22.0%
No answer	4.3%
Is it only car in family?	
Yes, it is	56.6%
No, own another	41.7%
No answer	1.7%
What is other car?	
Big Chevrolet	31.1%
Another GM make	25.3%
Ford Motor make	12.0%
Foreign make	11.5%
Chrysler make	10.0%
American Motors make	2.9%
Stude-Packard make	1.9%
Other U.S. make	5.3%



Army Howitzer Weighs Eight Tons Less

Carrying a load of 89 rounds of ammunition, the Army's new howitzer is air-transportable and has an aluminum hull. It is more than eight tons lighter than older types of 105-mm. self-propelled howitzers.

The machine has an improved fire-control system and is more accurate. In addition to firing standard howitzer rounds, it can handle a new, longer-range type of projectile.

First Diesel Outboard Motor

Entering the outboard motor market, American Marc, Inc., of Inglewood, Calif. is producing a single-cylinder (two-piston), air-cooled diesel rated at $7\frac{1}{2}$ horsepower, with 15 and 22-horse models planned. Diesels are heavier and more expensive, but operate at lower cost, use less-dangerous fuels, and eliminate ignition systems, carburetor and valves found on gasoline engines.



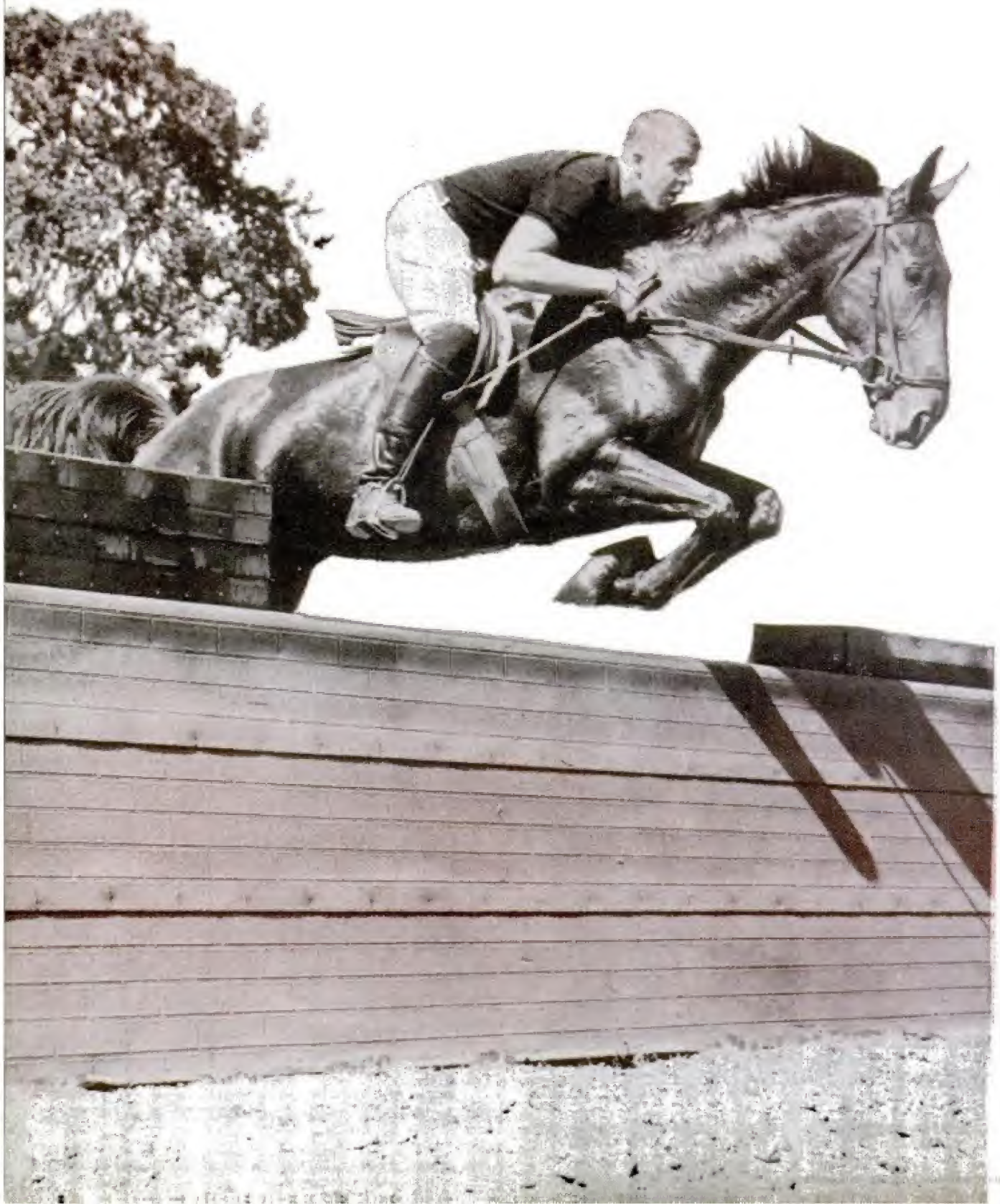
Safety Switch Cuts Off Car's Power

Protection in the car from fires, smoking wires and continuous horn blowing is possible with a battery switch that cuts off all current. Installed near the battery, the unit is operated from the dash by means of cable and control button. Locking the button in glove compartment prevents car theft.



Olympic Horsemen Go to School

By Dale Allen



In and out. Preparing for the second day's Olympic events—which include harassing jumping conditions, Walter Staley jumps his horse into a water trough as team trainer Eric Bubbel watches for flaws in his style



SIX YOUNG MEN and 18 horses have been training six hours a day, six days a week, for the past two years to represent the United States in one three-day event at the Olympic Games, which will be held in Rome, Italy, this year, from August 25 through September 11. The men, candidates for the Three-Day Endurance Equestrian Team of three riders and an alternate, can look forward with some confidence to making a good showing, for they are receiving a rigorous schooling—on a specially designed training field at Rancho San Fernando Rey, near Santa Barbara, Calif.—not only in the events in which they will participate, but in exercises devised to add powers of endurance to both horse and rider. By the time they arrive in Rome for their contest—to be held from September 5 through 7—they will have put in 797 full days of training for a total of 4482 hours. Each man will have ridden more than 100,000 miles while putting himself in shape and training the two horses he will take to the Games. Their confidence, however, will be tempered by the knowledge they will be competing in one of the most

grueling tests ever designed to make a rider lose control of his horse. For example, at the 1956 Olympics, held in Sweden, 160 riders started the second day's events, but only 17 finished. Also, they will be riding for the stake of national pride, for the United States has won this event only twice before—at Los Angeles in 1932, and at London, in 1948.

The Three-Day Endurance Equestrian test (there are two other horsemanship events at the Olympics—the Grand Prix de Dressage and Grand Prix Jumping—but they will be entered by two other teams) is, roughly, the horse world's equivalent of the track-and-field decathlon. That is, the competitors must do well in many different events. The first day they will ride in a dressage meet, putting themselves and their horses through a series of complicated steps and motions. The second day is devoted to cross-town and cross-country riding, which must be performed within a time limit, and the third day will be devoted to jumping. What makes the contest tough is the rule that the same rider must keep the same mount through-

Up and over. Ernest Simard, one of six candidates for the U.S. Three-Day Endurance Team, skillfully lifts his horse over a high, wide jump. He and others appear in weekend horse shows to improve selves for Olympics





Ankle-high bars, above, are an exercise rack which help instill in horses the instinct to jump. The rider is John Plumb



Jumps at a gallop. Preparing for the second day at the Olympics, team candidates (above and below) leap 50 obstacles in five miles



out and he must always keep advancing, except where the rules specify a stop. Otherwise he is disqualified.

The six United States candidates—Walter G. Staley, Jr., Mexico, Mo.; Ernest E. Simard, Monterey, Calif.; John M. Plumb, Syosset, N. Y.; William D. Haggard, III, Nashville, Tenn.; Michael O. Page, Briarcliff Manor, N. Y., and John E. B. Wofford, Milford, Kans.—work out on the ranch under the guidance of team trainer Eric Bubbel, a former Olympic equestrian champion. Each rider, even though he may be as skilled as Walter Staley, who competed in the 1956 Olympics, receives individual instruction. Schooling is not limited to daily training, either. Every second weekend, a complete horse show is held in which candidates compete in duplicates of Olympic events. Several times a year a complete set of equipment is moved to local horse shows, where the candidates perform before large crowds. The team is sponsored by the United States Equestrian Team, Inc., an organization that underwrites the United States' entry into world horsemanship events. This organization took over the sponsorship from the U.S. Cavalry 10 years ago and since has provided, at the ranch, the best training ground any U.S. endurance team has had. Two hundred miles of trails climb from near sea level to 6000 feet and were made to strengthen both men and horses. There are three dressage arenas, a stadium jumping course with regulation Olympic jumps that must be taken at the rate of 380 feet a minute, and a cross-country course that offers 50 fences, ditches or traps.

"We emphasize the essentials at this school—that the horse must be fit to the rider and the rider to the horse, and that, at the end, there is no substitute for plain old guts in both," says John Galvin, the ranch owner and a student of Olympic equestrianism.

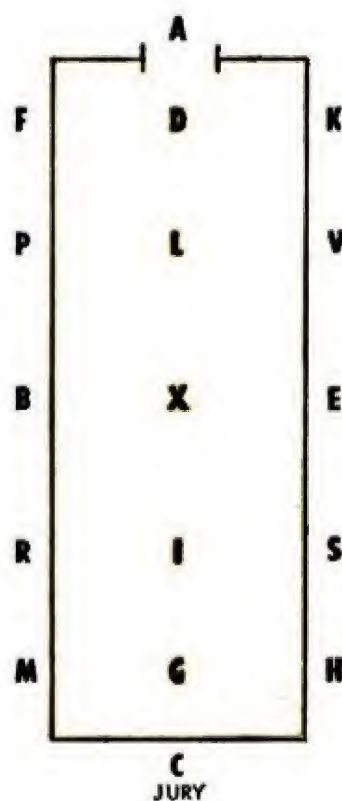
"Dressage, the first day's event, receives more attention than any other single phase of our training," says trainer Bubbel. "Each rider takes personal instruction and practice in dressage two days each week, compared with one day of practice on other subjects."



Dressage, perhaps the fastest-growing phase of equestrian sport in the United States, is founded in the classical schools of horsemanship and aims at outstanding achievement in balance, coordination, and subtlety of horse movement. In this test, each competitor, riding in a 20 by 60-meter dressage arena, has exactly 12 minutes to put his horse through a complicated series of steps and movements. There are three dressage arenas at the ranch. Two are outdoors and one is in a steel building constructed especially for training the Three-Day Endurance Team. To help riders check on the movements of themselves and their horses, it is equipped with three 6 by 10-foot mirrors along one side, and two at one end. The dressage arena is marked down the center with seven letters, and along each side with five. Each of the steps and its movements must be done on a course between designated letters. The center lettering, starting at the top is A, D, L, X, I, G, C. At the left, along the side, is F, P, B, R, M. Along the right is K, V, E, S, H.

When a rider starts the dressage, he enters the arena at A, at collected canter, rides to X, in the center, halts, salutes, then proceeds to C at the center of the other end of the arena. He then tracks to the right, to M, crosses at X and K and, while following this route, changes reins at extended trot while rising, then proceeds from K to A at an ordinary trot, sitting. He goes immediately into the next step and continues to do so in a precise order, entirely from memory, until he has completed the required 30 steps and movements. This, of course, puts rider and horse under heavy mental strain, for it requires concentration by both. The rider must remember every step in its order, and the horse must accept the almost imper-

Putting his horse through the paces of dressage, a candidate performs before a weekend crowd in a 20 by 60-meter arena marked with letters, as shown below, which set his course for 30 steps and movements





Three of the five mirrors mounted inside one dressage practice arena reflect the controlled movements of one candidate and his horse. Dressage tests the rider's ability to subtly control his horse and keep balance

"We have a rugged course through the hills in which the rider and his mount must jump 30 fences and 20 traps and ditches. These include the same kinds they will encounter in the Olympic Games, among which will be water, slips, slides, fences with ditches adjacent, and farm implements inside buildings and on the trail."

If the rider and his horse are still in shape after the second day's tests, they compete the next day in a 14-jump Olympic stadium course. It is a tough test because by this time both rider and horse are tired, and because the jumps themselves, which go up to seven feet in height, would be demanding, even for fresh competitors with strong horses. Scoring is based on the number of times hooves strike the jump barriers, the horse refuses, and the smoothness of ride.

The schooling is designed to instill the ability to make judgments instinctively. Action and thought must be simultaneous, as was demonstrated by a rider in the 1956 Olympics. Riders are allowed to walk over the course so they may plan their actions. One rider who had studied the course carefully found, during the contest, that as he approached a high jump with a deep, muddy ditch on the other side his competitors had disappeared. Without a moment's hesitation, he circled to his left to gain more speed and jumped his horse over the obstacle and the nine horses and riders who had jumped too short and were struggling in the ditch.

This year the sponsors of the United States Three-Day Endurance Team believe they have men of high quality who will bring their country international honor.

Team trainer Eric Bubbel signals candidate John Plumb, who is taking his horse over one of the 14 Olympic-styled jumps at their ranch training school.





Tall Boat!

Boats that ply the rocky Douro River of North Portugal, transporting grapes used in making port wine, at first glance look as though they have been stretched out of shape. A long wooden sweep, controlled from a high, platform deck, serves as tiller and rudder, and the square-shaped sail looks as though it were hung too high. Actually, the boat, known as a Rabelos, is quite functional in design. Most of the vineyards in the area are located close by the Douro and this river has high rock walls which shut off visibility around bends and prevent the sail from catching the lower winds, thus making a tall sail and high deck necessary.



Fish Dispenser

Fish—rather than cool drinks—come out of a converted pop-vending machine for visitors who wish to feed the seal lions in a Garden City, Kans., park. The machine has a revolving cylinder inside, partitioned off into 83 compartments. Fish are placed in these compartments, which were designed originally to hold the bottles of cold drink. Claude Owens, park superintendent, displays a package of the fish.



Buoy Unloads Oil

No mere navigational marker, a new buoy which has been put in use off Stockholm, Sweden, is an offshore unloading terminal. It is capable of handling oil tankers of any size. Developed by a Swedish firm which also includes American engineers and businessmen, the buoy is hooked to submerged pipelines which carry the oil ashore. This eliminates the need for docks and harbor facilities. Vessels can swing 360 degrees around the new device, always heading into the wind, thus making it possible for them to unload even in winds up to hurricane force.

ⒾManned rockets, capable of boosting satellites into space and then returning to the launching site, are being studied by Convair engineers.

This Company Loves Tough Problems



Balloon designed by ADL will shoot from a rocket to record density of atmosphere 300 miles above earth

By Wilbur Cross and Hart Leavitt

WHEN A LARGE publishing firm developed a new type of printing plate, but needed a better understanding of the chemistry and physics involved in putting the plate to work, it turned for help to ADL. When a plywood manufacturing company found its gluing machines did not always apply the thin film of glue properly, an executive said, "Let's give the project to ADL." And when another manufacturing company found it did not have facilities to test a new type of parachute cord at high altitudes and low temperatures, it knew exactly who could do the job—the staff members at ADL.

"ADL" is simply the popular name for the Cambridge, Mass., research firm of Arthur D. Little, Inc. During the past 75

years, it has tackled more than 60,000 problems in almost every field of endeavor and built its reputation by finding solutions, as it did for the problems mentioned above. No assignment is ever greeted with surprise at ADL which, as one of the most successful research and development firms in the world, has helped to improve almost every type of product from ladies' girdles to uranium mining machines, from false eyelashes to mud huts.

ADL's accomplishments result, in large part, from its philosophy of encouraging staff members to take fresh and unique approaches to each problem. In fact, the firm will sometimes assign the problem to a man who is not an expert in the field in which it falls. A project that is basically



ADL Operations Research Team analyzes what will happen when a company uses manpower, time and money in different ways. The team also studies how to develop equipment and formulas



Egyptian farm workers mix mud with a petroleum by-product, bitumen, which makes their mud huts resistant to rain. ADL suggested the technique as a means of helping solve a housing problem for over 16 million workers



Before: Some Hondurans lived in ramshackle houses made of wood and ADL's problem was to find how they could help make their own houses at low cost

Woman putting steak in broiler works at ADL's Flavor Laboratory, where researchers try new food products. The test here is to measure the effect, on meat, of a new tenderizing substance



one of mechanical engineering may be solved by a staff member whose background is chemistry or electronics. A problem in air conditioning may be handed to a team consisting of a psychologist, a meteorologist and others who have never seen the inside of an air-conditioning unit.

"The Lord deliver us from experts," says the company's president, Dr. Raymond Stevens. He does not mean this in a talent sense, for ADL employs some of the finest thinkers in the world. What he believes, rather, is that every research problem should be approached with an open mind, imagination and a high degree of old-fashioned common sense.

This approach was interestingly demonstrated when a manufacturer of seismographs and other recording instruments came to ADL for help. "We make the finest precision machines in the world," he explained, "but they aren't working properly. The ink won't flow through the recording needle, and we think we need a better type of ink."

The problem was given to Raymond James, who had no experience with either seismographs or ink. James did not rush to the library to bone up on these subjects, nor did he even make a thorough study of

the company's instruments. He simply shuffled around the corridors and thought about what was most important: the end result, which was recording seismograph readings. He found the answer one day while staring in thought at the floor. Noticing the whitish glaze on the waxed surface and the scratch marks that stood out against it, he began to wonder. Instead of using ink, the best of which could run dry, why not use a stylus on a soft surface? The theory was tested, put in practice with plastic instead of wax, and resulted in one of the most valuable developments in the client's long history.

Time and again, ADL has put this kind of homely imagination to valuable scientific use. One such development, which has saved millions of dollars for the steel industry, came about, partially, because of an ice-cream cone. While doing research for Republic Steel, Dr. Bruce Old noticed the dangerous practice of "tapping" blast furnaces. Workmen, in order to take samples of molten steel, had to knock out a clay plug at the furnace flow hole with a steel bar. It was slow and difficult work and exposed the man to splattering slag. Dr. Old wondered how to lessen the danger. His moment of inspiration came when

After: ADL representatives suggested that lime be mixed with mud, which could be made into weather-resistant bricks. The firm also drew up house plans





One of the few products ADL makes is a helium liquefier for attaining temperatures as low as -270 degrees C. It is used by 85 percent of this country's low-temperature research labs



THIS IS THE SILK PURSE MADE OF A SOW'S EAR

To show the futility of negative thinking, Arthur D. Little, founder of the firm, made a "silk purse from a sow's ear." It illustrates the company philosophy of taking fresh approaches

he saw a child sucking an ice-cream cone. It reminded him of the shaped charges of explosives, used during World War II, fixed to long poles, to blast barbed-wire entanglements. Because of the shape, the force was directed forward, away from the user. Old tried a similar device for the "tapping" process. It worked so well it is now employed in 80 percent of all U. S. blast furnaces.

ADL's common-sense approach is nowhere better illustrated than in the perplexing case of the mud huts. In 1952, the Egyptian government was faced with a crisis in an age-old problem: housing for some 16 million farm workers on whom much of the economy of the country depended. The workers lived in huts of sun-baked clay made after the manner of their ancestors 5000 years before. When the rainy season came, the huts would disintegrate. Not only were the costs of tents and prefabs too high, the farmers refused to occupy such unfamiliar dwellings.

In desperation, Egypt contracted with ADL to have staff members Drs. Charles Harford and Earl Stafford flown to Cairo to search out a solution. They made field tests which were supplemented by law work back at ADL's Cambridge offices and came up with an answer: Let the farm workers continue to build the traditional mud huts they preferred. But show them how to mix the wet clay with bitumen, a cheap petroleum by-product abundant in Egypt. Bitumen barely changed even the color of the huts, yet it made them rainproof.

ADL's approach to problems has stood the test of time, for it was formulated 75 years ago by a man who knew how to combine genius with the common touch: Arthur Dehon Little. Forced to quit Massachusetts Institute of Technology at the age of 22, in 1885, Little faced the world with no job, no assets, but with a remarkable working philosophy. There were four characteristics he would demand of himself (and later of his associates): "The simplicity to wonder, the ability to question, the power to generalize, the capacity to apply."

(Continued to page 260)

POPULAR MECHANICS



Women in Giant "Sewing Bee" Prepare Fabric for Blimps

In what might be called the world's largest "sewing bee," scores of women in Litchfield Park, Ariz., spend eight hours a day cutting and cementing together huge envelopes of rubberized fabrics. Their job is making gigantic U.S. Navy blimps. On hands and knees, they cut the fabric according to pattern. When the envelopes are inflated, they stretch a block long and several stories high. The end result is a blimp finally completed in Akron, Ohio.

Chemical Spray "Prunes" Trees

Sprayed onto lemon trees, a chemical, maleic hydrazide, "prunes" by retarding new growth without harming older foliage or preventing the development of fruit. Experiments were carried out by Ventura Coastal Lemon Company with a spray that consisted of a 500-parts-per-million concentration of maleic hydrazide in water. The chemical caused fast-growing limbs to die—and by diverting the trees' energy, encouraged the production of better fruit. It had previously been used to inhibit the growth of fast-growing plants such as ivy.





Two climbers negotiate a tricky "chasm" in one building while another maneuvers on a vertical brick wall that's almost as formidable as a mountainside

Amsterdam's Saturday Mountain Climbers

AMSTERDAM, the capital of a land that's flat as flat can be, is nurturing a group of mountain-climbing enthusiasts who practice on a "mountain" in the center of the city every Saturday afternoon.

The climbers are members of the Amsterdam section of the Austrian Alps Association. They practice on a training tower used by the city's firemen. This way, they manage to keep in shape for their holidays in the Alps of Italy, Austria and Switzerland...or their rehearsals for those formidable giants in the Ardennes and Eifel Mountains of Germany.

Clad in heavy boots, sweaters and wool caps, and carrying ropes, axes and the tackle they use for climbing real mountains, they put on a spectacular show every weekend for their fellow Amsterdammers.



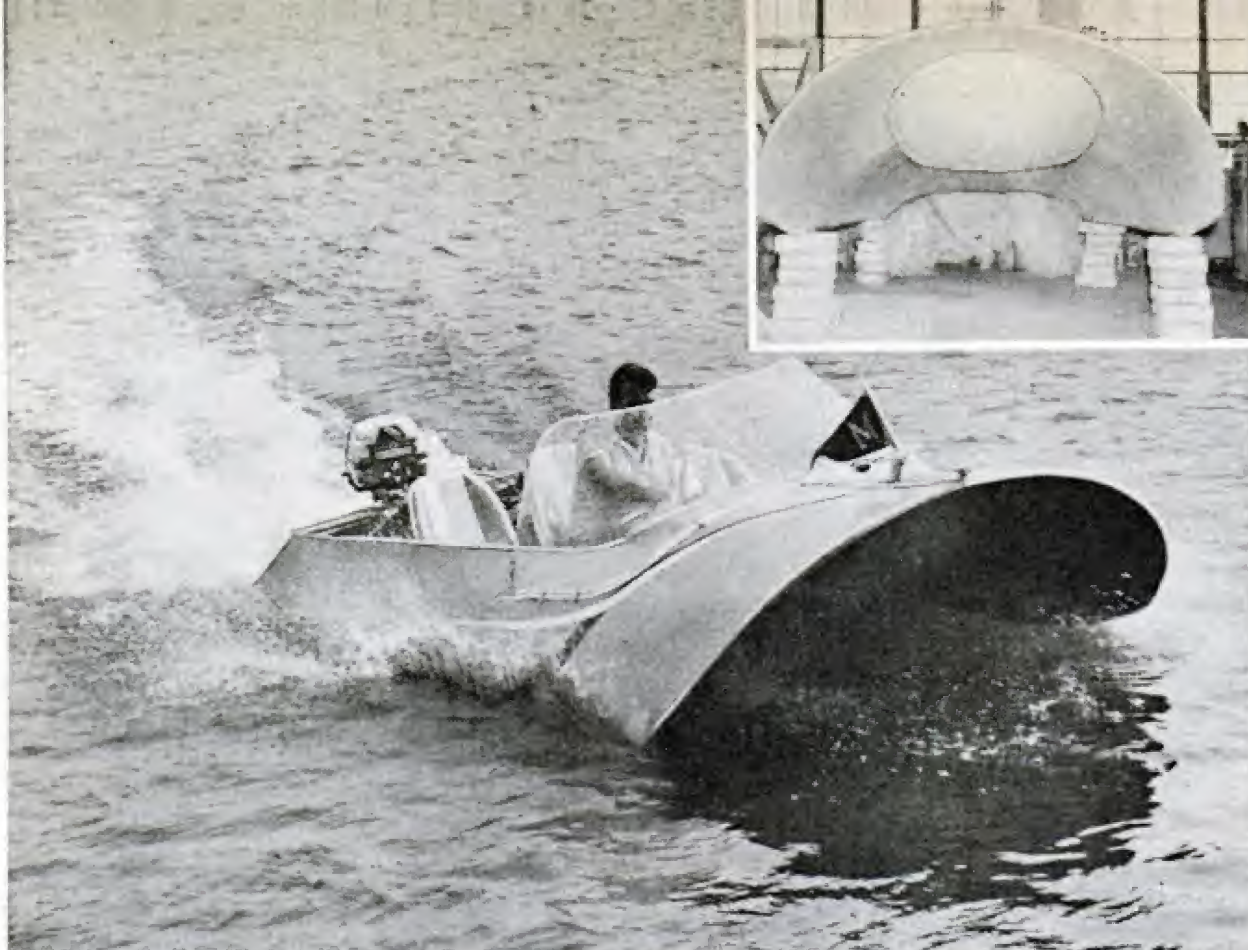


Firemen's training tower in Amsterdam serves as a mountain for members of the Austrian Alps Association

Two climbers in a practice rescue operation are supported on a slender but amazingly strong nylon rope

He made it to the top! Next he'll try the Eifel Mountains and the Ardennes—then on to the Alps





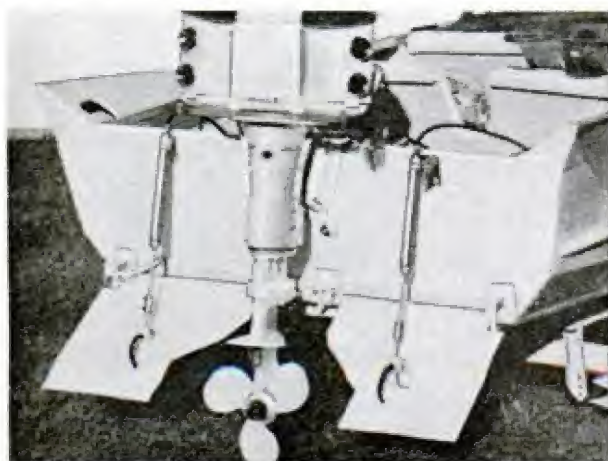
All-Aluminum Catamaran Uses Crescent-Shaped Hull

Its crescent-shaped hull skimming the water on edges of aluminum, a new catamaran streaks along at speeds up to 50 miles per hour when powered by a 35-horsepower motor, and up to 22 miles per hour on a 16-horsepower outboard. The boat is 14 feet long and 8 feet wide and has a cockpit beam of 45 inches. The hull is

made of welded tubular aluminum covered with a high-stress aluminum alloy. It has upholstered bucket seats which contribute to the smooth ride. The experimental catamaran was built by a commercial builder seeking experience in this type of construction and, as yet, there is no plan to put the design into commercial production.

Trim Elevators for Boat

Stern elevators suitable for both inboard and outboard motor boats can be adjusted to give the desired planing attitude by a new control system. When the boat is moving, water pressure against two stainless steel elevators is introduced into two hydraulic cylinders where it provides power so the boater can adjust the elevators. The system has finger-tip controls.



Look, Fishermen — No Hands!

Fishermen now can have both hands free for fishing and still control their boats when they are moving at low speed. A new tiller control, boxed in cast titanium, responds to foot pressure, allowing a fisherman to adjust direction for current, wind drift and the changing shoreline. Its manufacturer says the control will turn a fishing boat 360 degrees in approximately 20 feet.



"Pontoon" Tires Float Marsh Buggy

Churning through swampy areas carrying prospectors for oil, a 4000-pound marsh buggy actually floats on its five-foot-high "pontoon" tires. The tires measure 42 inches wide and 18 inches at the hub. When inflated to proper pressure, they can float the unusual vehicle through marshes and swamp areas while it carries a 4000-pound payload. The marsh buggies will find use in oil exploration and as personnel carriers.



Largest Mail Sorter Zips Through Letters

Doubling the capacity of any existing machine, the world's largest letter-sorting machine handles 36,000 letters an hour. The machine, installed in the Detroit post office, can be equipped with as many as 12 separate operator keyboards, each handling intermixed letters. As a letter is placed automatically on a scanning board, the operator reads the address and presses a destination key on the console. The letter drops into the conveyor system which consists of 161 letter carts constantly in motion. An electromechanical code signal then releases the letter into the proper sorting bin, of which there are 279. The sorting bins (right) are arranged in tiers for easy access. When any of the bins is near capacity, an alarm signal at the supervisor's control station gives a warning. Automatic counting devices register the number of letters sorted by each operator.



☐ The Federal Aviation Agency has established 60 as the mandatory age for retirement of airline pilots.



TILTING PICTURE WINDOW can be swung downward into a room to lie flat for easy cleaning. The window, with side frames of rustproof metal, can be raised or lowered in the conventional manner. It also may be tilted at an angle for ventilation

Safety Window Hardware Corp., 121-127 Thirtieth Street, Brooklyn 32, N. Y.

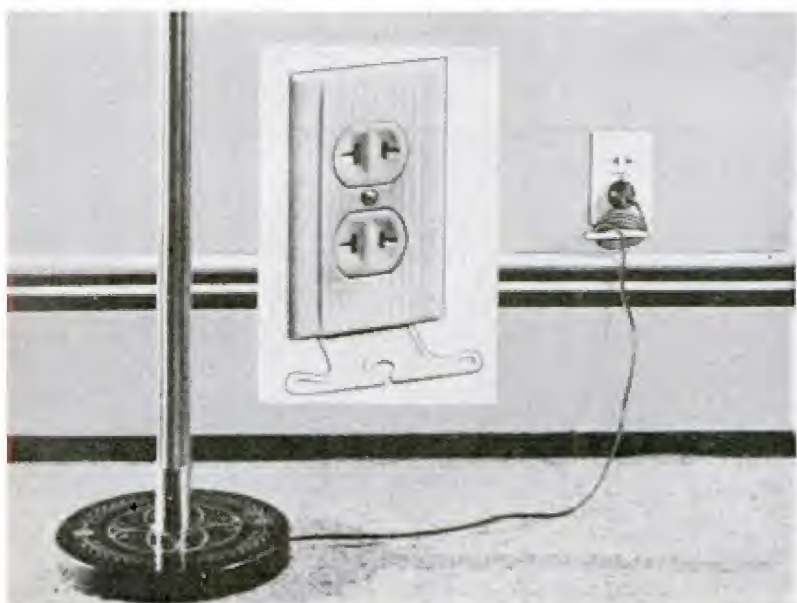
PORTABLE STEP, which comes in 11 colors, has a built-in safety device: When weight is put on the rubber-treaded platform, the casters on which it moves retract, lowering the base to grip the floor. In its lowered position, the platform will not wobble or slip. When weight is removed, the casters again lower to rolling position and the unit can easily be moved, with the foot, to a new location. The step stands 14 inches high, has bumpers completely around it, and can be used as a stool

Cramer Posture Chair Co., Inc., 623 Adams, Kansas City 5, Kans.



CORD CADDY, made of a plastic built to withstand bumps without breaking, permits you to reel up appliance and lamp cords to prevent entanglement and floor clutter. It is attached by removing the outlet faceplate, setting the caddy in place, and replacing the plate. It is easy to use: Unused cord is reeled around the caddy, then pulled through a slot which holds the loops neatly. Two of the cord reels may be installed on one wall outlet, an advantage in the use of kitchen appliances

Brittain Sales Corp., 777 Copley Rd., Akron 20, Ohio



STORAGE CHEST for the protection of sweaters and other small woolen garments against moths is made from aluminum laminated to paperboard. The chest measures 3 by 12 by 15 inches, and is collapsible for storage when not in use. Moth balls or flakes may be placed in the chest, which will retain larva-killing vapors

Bala Products, Box 337, Bala-Cynwyd, Pa.





Fishing Junks Get Diesel Power

One hundred fishermen in South Vietnam no longer have to paddle their junks laboriously to pull in fish-laden nets. They are the first to receive a $2\frac{1}{2}$ -horsepower diesel engine that was designed particularly for their boats, which have bottoms of bamboo mats. Ordinary engines shake the fishing junks apart. The new diesel has a V-belt drive and mounts on the side of the boat. It has a retractable propeller assembly, so as to not drag bottom when the junk slips out to fish under thatch sails. The engine was designed in Japan.

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The Watchmakers of Switzerland photos

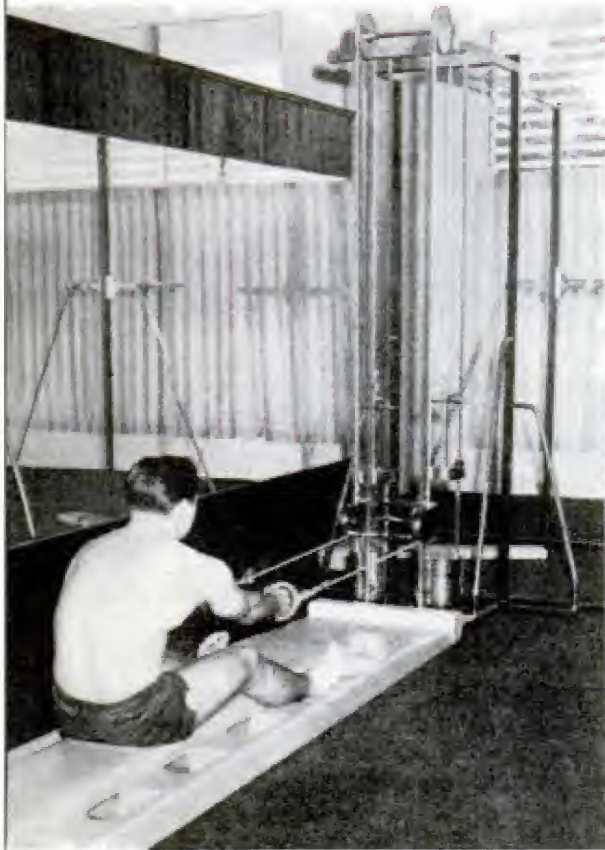
A black and white photograph showing a close-up of a man's hand. He is wearing a wristwatch with a light-colored face and a dark strap. His fingers are gently resting on the shoulder of a woman, whose shoulder is visible in the lower part of the frame. The lighting is dramatic, with strong highlights and shadows.

A black and white photograph of a person's wrist wearing a wristwatch. The watch has a round, light-colored face with a dark dial and a dark strap. The person is wearing a light-colored shirt cuff.

SLIDE RULE watch has outer rim that turns for calculations. It multiplies, divides, takes cube root and acts as a stop watch

Physical Fitness Factory

By
Jack B. Kemmerer



Excess weight on the sides and thighs is removed with Vic Tanny's Lat Pulley

PHYSICAL FITNESS—that nemesis of the overweight and the underweight—suddenly is enjoying rejuvenated popularity. Body builders like Charles Atlas, Joe Weider and Dan Lurie, striving to provide better bodies, are finding zealous students for their offerings.

Why the need? Automation, is the most frequent answer. Because machines instead of muscles are doing the work, people have become sluggish, sickly and sometimes emotionally disturbed. Now they are finding in physical exercise real constructive fun.

One muscle-builder, however, has looked automation squarely in the eye. He's taken the machines of the automatic age and put them to work making people physically fit.

Vic Tanny, physical culture expert, has designed and built a set of complex machines that can remake any part of the body. His gyms across the country look like factories, except that the people in them work the machines instead of letting the machines work them. Weight-resistant pulleys and bars force the individual to use his own muscles to operate them.

To Tanny, there is no such word as "reduce." He tags his process, "normalizing" the body.

"When a person comes to us for help," says Tanny, "the gym manager evaluates weight, height, age, condition, needs and desires of the person. Then a program is started to bring that person to normal."

In the United States, only 10 percent of the people can be called normal, according to Tanny's

Pulling and contracting on Long Pulleys, this young lady will add inches to bust line and reduce or build up hips



Women find Tanny's Leg Extension Table a convenient way to develop their thigh muscles





One application of the Smith Bar: as trainee tries to stand while raising weight, he develops lower body

definition. Of the other 90 percent, 20 are underweight and 70 overweight.

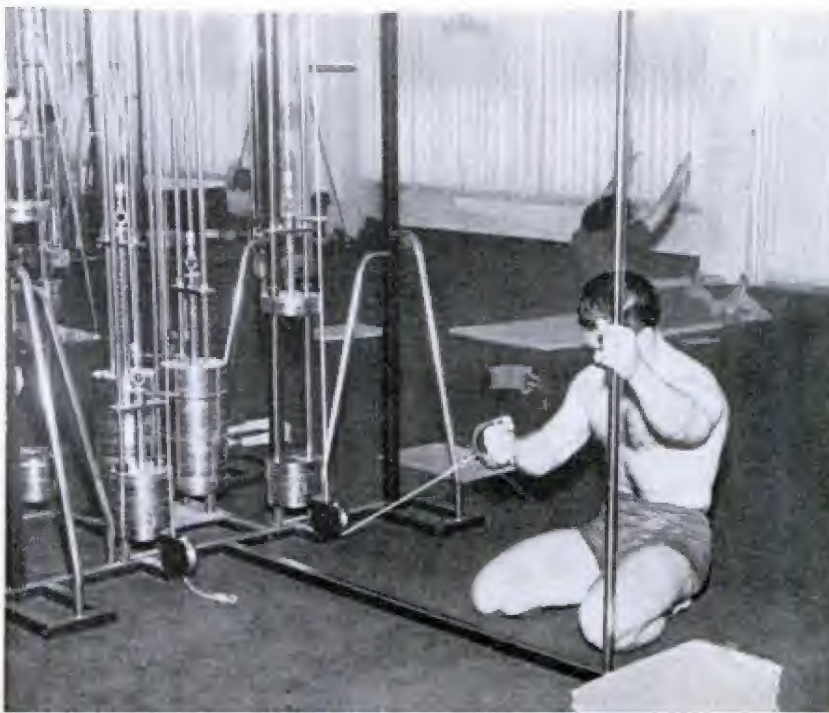
In starting a program for a new member, Tanny's instructors assign each person to the pieces of equipment aimed at his particular development. If someone wants to get his thighs or chest into shape, he is assigned to the Smith Bar, which is equipped

with variable weights which he must move with his legs or arms.

If an otherwise charming young thing wants to develop her bust or build up her thighs and hips, she is assigned to the Long Pulley, which adds inches and firms the bust muscles. One fascinating machine is the Jungle Pulley. It has six different work-

Six persons can use the Jungle Pulley at one time. Any part of the body can be strengthened. Here fore and upper arm are worked on

This girl is using the Jungle Pulley for upper arms and back





Thigh muscles are developed quickly by lowering one of the weights on the Jungle Pulley



Another Smith Bar application, these weights and pulleys develop leg, thigh muscles when they are raised, lowered

ing positions that develop any part of the body. These and other machines are found in each Tanny gym, valued up to \$50,000.

Once the person is introduced to the equipment, he spends his first two weeks in a basic conditioning program. By the fourth week, the training is tailored to his own needs.

Through proper use of these machines, Tanny's gyms help people do many things with their bodies. It is quite easy for members to gain or lose 10 to 20 pounds, add or lose two to four inches at the bust line and add or lose one to two inches on the thighs.

The normalizing period lasts as long as each person wants. It lasts until he or she has gained or lost the weight desired or developed the muscles needed. By gradual strengthening of muscles, the Tanny method allows a person to stop whenever he wants. Thus he or she can build the exact muscular structure desired, without forming bulging muscles.

Women actually have been greater users of Tanny's principle of body building than men. This, Tanny admits rather candidly, is because women are more figure conscious than men. ★ ★ ★



Double chins and wrinkles find their cures with this mechanism on the Jungle Pulley. It lifts the head to help correct possible posture defects at the same time

Long Lever Swings Boat Onto Dock

With an L-shape lever, one man can lift a boat weighing up to 500 pounds from the water and tilt it on its beam for cleaning. The lifter is made of three-inch pipe. The hinge at the fulcrum is formed by a pipe sleeve rotating around a hinge pin of smaller pipe that has been secured to the edge of the dock.



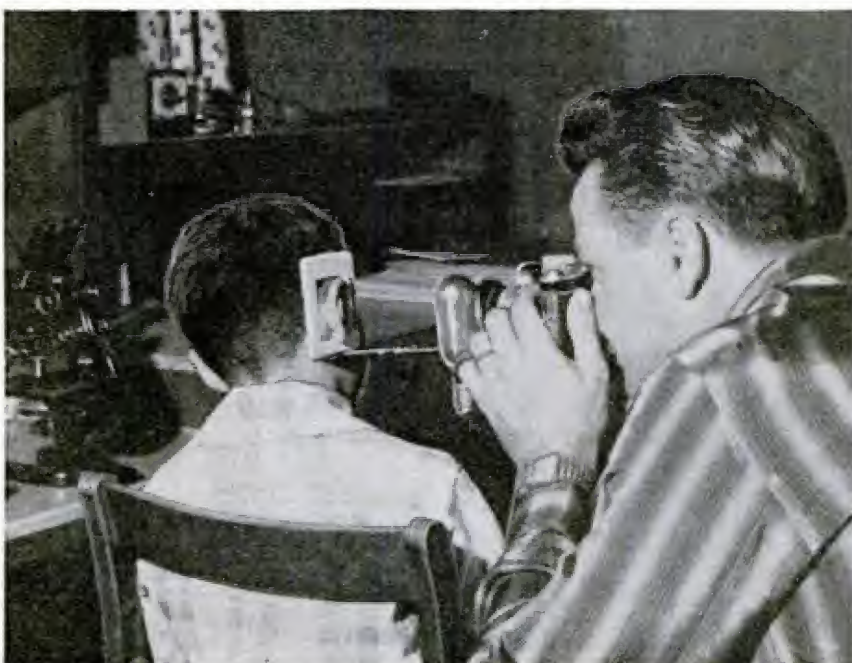
Custom Auto Body Finished in Mosaic

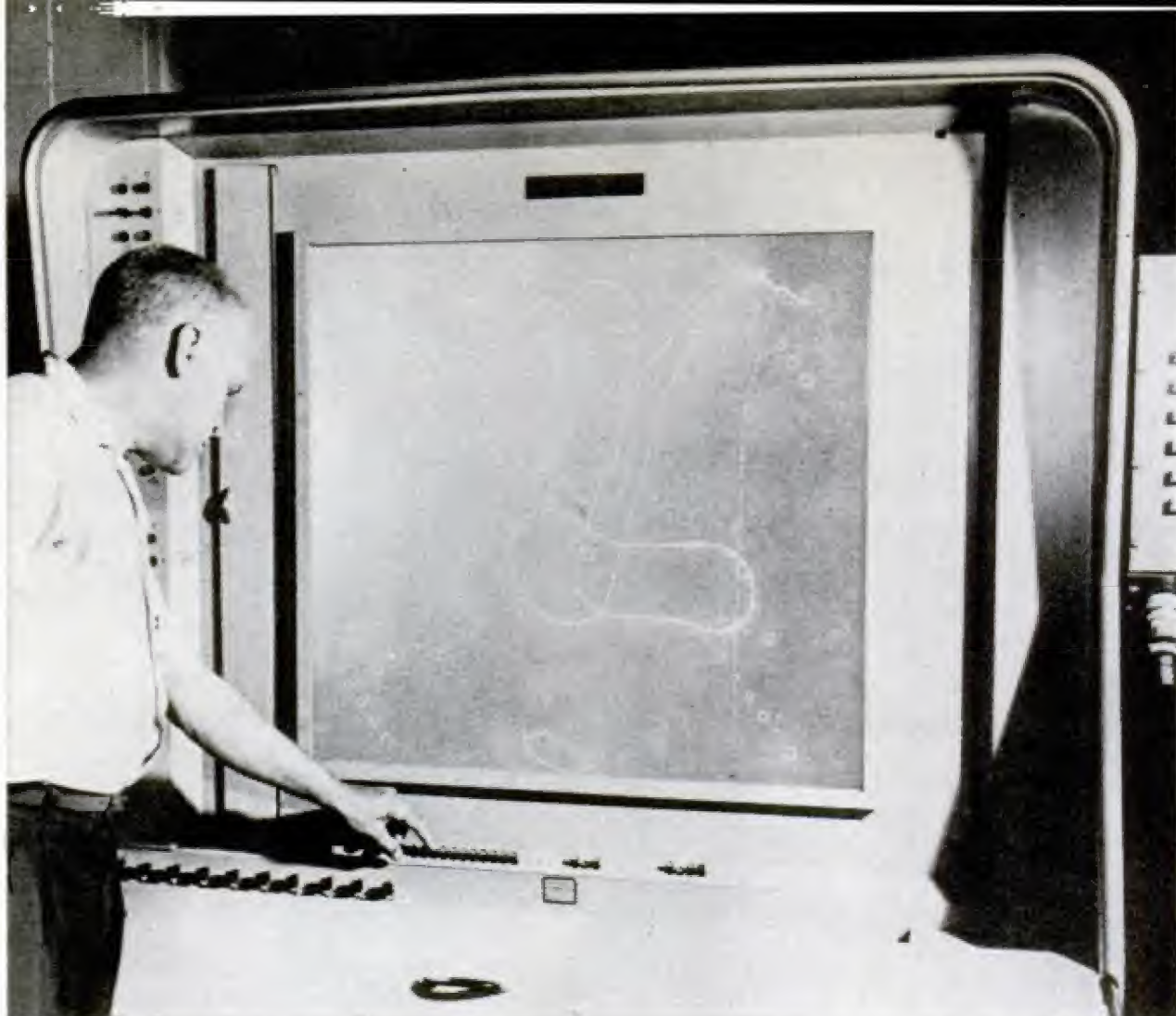
Few custom car bodies can equal the one designed by Niklos Bel-Jon, a San Francisco artist. After obtaining a 1938-model car, he replaced the top and hood with Fiberglas and added Fiberglas fins. Over all of this, he applied thousands of aluminum mosaic pieces. A year and a half of spare-time work and a considerable amount of money turned the car into an eye-stopper.



Beware! Your Ears May Give You Away

"Earprinting" — using characteristics of the human ear for identification — soon may serve law-enforcement bodies as a valuable adjunct to fingerprinting. Developed by A. V. Iannarelli, an Alameda County, Calif. deputy sheriff, the new method can be used where fingers are mutilated from burns. Iannarelli anticipates that it will replace footprinting of babies, too. With hundreds of ear pictures on file, he has found that even two ears on the same head are different, and that identical twins have different ears. He says that basic ear features stay the same for life.





U.S. Navy photo

Huge "TV Screen" Plots Aircraft Thousands of Miles Away

Airplanes approaching from thousands of miles away are plotted by a new system, Iconorama, that resembles a huge television screen. Radar information about such planes is fed to the machine, causing a stylus to scratch a trace on a slide that is then automatically projected in register, and with an identifying color, onto the

viewing screen. Iconorama handles four times as much information as that plotted by clear plastic panels in use since World War II, and will be installed in top U.S. air-defense centers. In a special application at Pacific Missile Range, Point Mugu, Calif., viewers wear polarized glasses and see objects up to 50,000 feet in three-dimension.



Tape Holds Photo Lamp

Compact enough to fit in your pocket, a photo-lamp mount can be attached to a wall or mounted on a stand. Its versatility enables the photographer to travel light and still have top or backlighting without booms or overhead rigging. The lamp is held to the wall by a special tape that supports it securely without marring the surface. A notch and chain arrangement locks the light on a stand, pipe, piece of furniture or door. Complete directional control is provided by a swivel which has a tension adjustment. Heat-insulated finger grips allow the photographer to turn the lamp without burning his fingers. The socket of the lamp is porcelain, the cord is neoprene and the other components are made of aluminum and brass. A supply of tape is furnished with each mount.



Small Electric Boat Sneaks Angler Into Good Fishing Holes

Only 7 feet long and 42 inches wide, an electrically-powered Fiberglas fishing boat will ease its occupant into remote brushy areas where the big ones lurk. When fitted with a low-powered outboard motor, the boat will also negotiate rougher water. The craft's quiet-running electric motor is located in a center well and is powered by

a six-volt car battery. The inventor, an airline pilot who now manufactures the craft, has also devised a control system by which he steers the craft with his knee while using a foot feed for speed control. This arrangement leaves both hands free for fishing. The craft can be carried atop a car or in a station wagon.

Giant "Footballs" Protect Freight

Pneumatic cushions that inflate like giant footballs protect crates and valuable freight from damage during shipment by rail. Placed between boxes or between the ends of the freight cars and the boxes, the cushions replace wooden braces formerly used, and soften the jolts caused when trains start or stop suddenly or cars bump together. After they are placed between the crates, the cushions are inflated from a compressed-air line. When the train jolts, they compress, easing any fractional movement of the crates and preventing uncontrolled slides that are a major cause of freight damage in railroad transportation. At the destination, the cushions are deflated, rolled and returned to the shippers to be used again.





Helping a lady visitor make selections from their varied stock of small and medium-size cactus plants are "Cactus Slim" Moorten, his wife and son

Cactus to Order

By Robert Franklin Ames

GIANT HIGHWAY-CONSTRUCTION MACHINES have been stopped cold by a cactus out in the Southwest—but it wasn't because the prickly plant couldn't be crushed aside easily.

Generally, the machines were waiting while the plant was removed tenderly—and cautiously—for replanting by a tall, thin Californian named Chester Moorten. (If you live in the West, he's the one you know as Cactus Slim.)

Moorten and his wife, Patricia, of Palm Springs, have been rescuing irreplaceable cactuses for years. Some of the plants saved may have taken a century to grow.

Large plants, shipped in big tubs, were planted around this desert-landscaped home. After they took hold, other smaller varieties were added





"Harvesting cactus plants is mostly a matter of knowing how to pick them up," says cautious Cactus Slim

At first, plants were given to neighbors and friends for landscaping their lawns.

"This was a time when Westerners spent thousands of dollars duplicating Midwestern lawns," Moorten recalls. "I knew that desert plants could be used to make interesting landscapes, but at first no one thought much of the idea."

As time went on, though, demand grew, and he now gets orders from every state. He couldn't find enough plants to fill requests so he began to plant seedlings. While many cactuses mature too slowly for nursery stock, others, especially miniatures and small ornamentals, can be developed easily, he says. ★ ★ ★

Small plants are easy to tote about, but some large ones require the power of a tractor-mounted hoist



Robert Franklin Ames photos





Salt Water Made Fresh By Energy From Sun

Conversion of salt water into fresh water at the rate of three gallons per hour has been accomplished by an instrument powered entirely by solar energy. The salt-water converter operates on the principle of ionization. As brine flows through a series of electrodes, an electrical current causes the sodium and chlorine ions to separate. These ions form in deposits on the electrodes and can later be removed. The giant generator that furnishes power converts light into electricity by means of 7800 silicon solar cells. These cells are attached to a four by eight-foot panel. Ten individual small panels in various combinations provide outputs of from 6 to 60 volts, and current flows ranging from one-half to five amperes.



Helicopter Kite

Wind rotating the blades of a new helicopter kite stabilizes the toy to prevent the yawing and dipping common to other designs. Cone-shaped, with the large end at the front open to the breeze, the kite rises quickly when string is let out. A plastic cut-out of a pilot sits in front attached to the bridle string, and is held in taut concentration as though actually controlling maneuvers. The kite has side ports to let out surplus air and a plastic sheet is fastened to the front to prevent side winds from building up pressures that might spin the cone into a dive.



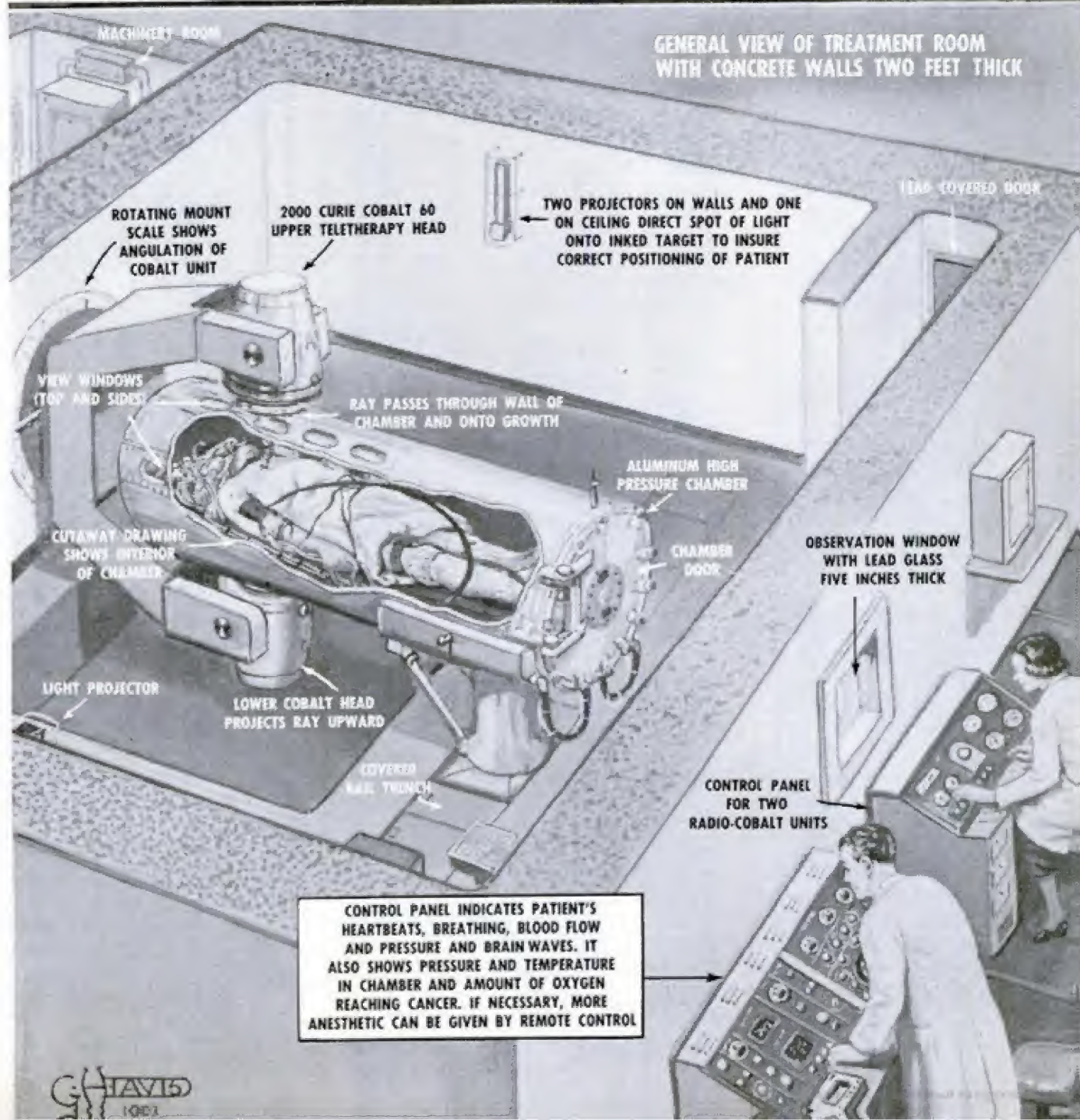
Morse-Code Sender Has Typewriter Keyboard

Anyone can send wireless messages in Morse code with a machine that has a typewriter keyboard. The machine, manufactured in Sweden, transmits the appropriate dot and dash signal for each key as it is pressed. Invented by a Norwegian radio operator, it is being installed in many lifeboats throughout Scandinavia.

ⓈPackaged instant bread that takes about 35 minutes to mix and bake now is included in field rations for the armed forces.

High-Pressure Oxygen Aids in Radiotherapy

ENCOURAGING results are reported by St. Thomas' Hospital, London, in treating cancer by high-pressure oxygen and radiotherapy. Anesthetized patients in the apparatus—first of its kind—breathe high-pressure oxygen. This assures a normal concentration of oxygen around cancer cells—which are often deficient in oxygen and thus up to three times less sensitive to radiotherapy than normal cells.





Dinghy and small motor were handy for short trips ashore

Annual Boating Section

OFFSHORE CRUISING

AFTER STOWING the last carton of provisions on board our 25-foot outboard cruiser, *Sea Joy*, the "mate" (my wife, Joy) took in the docking lines and we were on our way, bound for Key West 150 miles away. The twin motors dug in and beat a steady rhythm, pushing 3500 pounds of boat and load with ease down the Miami River to Biscayne Bay, one mile away then, good-by Miami!

Leaving on the tail-end of an ebb tide, we glided past sleek sailing yachts tied up at fancy hotel docks, big freighters and a miscellany of commercial craft. In a twinkling, the river was behind and the sparkling blue water of Biscayne went flashing by as speed was upped from the river's five-mile-per-hour limit to a brisk 20 miles per hour.

A warm breeze and bright sun made it an ideal day for our departure on a long-planned offshore cruise. The objective: two weeks of solid relaxation, skin diving, swimming in crystal-clear water, fishing, dinghy sailing, water skiing and anything else that might appeal to the mood of the moment. After several river and lake cruises by outboard and a number of ocean trips on medium to large sailing auxiliaries, we were ready to try offshore cruising by outboard boat.

The outboard's shallow draft allowed the skipper to run close to interesting shores, permitting an intimacy with places along the route that isn't possible with larger, deep-draft boats. At the same time, a well-built outboard cruiser, such as the all glass-fiber Larson model we used, can be taken offshore where only sky and water greet

the eye. Out there you are on your own, except for the distant help that a radio-telephone can summon for emergency assistance when in distress.

The wide sea is all yours except for the welcome sharing of it with a passing freighter or other commercial vessels. No crowded waterways here, with hot-rod boaters, fishermen, skiers, skin divers, fleets of small sailboats and other miscellaneous craft vying for the same water, mooring and shore facilities. For real relaxation and a new dimension in boating, try a cruise offshore.

A 20-foot cabin cruiser can accommodate a family of four or five quite comfortably, offering an inexpensive vacation package including fishing, water skiing, clamming, sightseeing and the thrill of going to sea in your own ship. In some coastal areas, offshore cruising provides an opportunity to "go abroad," even if only a short distance from the U.S. continental limits.

The 5000 miles of coastline on three sides of the United States offer every variety of offshore cruising. On the Atlantic side one can cruise on the rugged, cool Maine coast during the summer and bask in the semitropical warmth of southern Florida while the snow piles high in the North. Interesting East Coast cruise areas include Bar Harbor, Me., the Massachusetts coastline from Cape Anne to Cape Cod, Long Island Sound, Albermarle Sound, Chesapeake Bay and 1500 miles of Intracoastal Waterway. Some areas are wild; others are well stocked with shoreside establishments that permit eating and sleeping ashore in



Sea Joy passes through Jewfish Creek, one of many interesting channels between Miami and Key West

BY OUTBOARD

the best manner regardless of where you tie up for the night. The choice is yours, so plan accordingly, including stops for fuel as necessary.

Florida offers just about every variety of semi-tropical offshore cruising you could want, including foreign travel to the Bahama Islands, a British possession. Of course, anyone venturing on a voyage as extensive as the latter must be a qualified seaman, sail in a well-equipped, seaworthy boat, and time the cruise to coincide with favorable weather. Strong winds can produce a very lumpy Gulf Stream that must be crossed before reaching the shelter of the islands.

Bahamas and Gulf cruises are good just about any time of the year, except in January when fog and howling northwesterners are likely to make boating unpleasant in any size of craft. During late summer and fall months, boats at sea must keep a sharp lookout for storm developments. This means listening to official weather broadcasts regularly and being able to "read" a reasonably accurate two to three-hour forecast from a study of existing weather conditions.

We tuned in the nearest weather station on radiotelephone at all scheduled times when under way or planning to leave a port. A summary of each broadcast was entered in the ship's log as a matter of record and to aid shipboard short-range forecasting. Before leaving home port it's a good idea to enter the frequencies of such stations in your radio log book. Be sure to include all the stations along the cruise route since your equipment may not be powerful enough to pick up the home-port station. Broadcasts from a station in the locality being cruised also tend to be more accurate. Modern hurricane-tracking methods give the prudent sailor plenty of advance notice of the approach of the not-so-gentle lady windstorms.

By
Earl Wobeck



Author Wobeck sets compass monitor to the planned compass course to simplify navigation when the boat rolls at sea



"First Mate" Joy Wobeck doubles as cook and steward, and the day starts right with a hearty bacon-and-egg breakfast aboard



Above, Coast Guard "Courtesy Examination" at Hewes dock before shoving off. Below, Joy gets a lesson in wearing a life vest



Almost the entire Gulf Coast is dotted with interesting islands and island chains that are seldom more than 20 miles offshore and usually visible from the mainland. Their protection permits leisurely cruising in bays and lagoons when the water is rough on the "outside." Of course, the reverse can be true when you cross a wide bay or sound and a strong wind is blowing straight off the land or parallel with the coast. This happened to us on the second leg of our cruise, outward bound from Marathon to Key West. A strong northwest wind kicked up a very uncomfortable chop on the inside route, so we simply switched to the Atlantic side and traveled in the company of shrimpers, freighters and even a submarine that came close to admire our trim little ship. For an added bonus, a troupe of porpoises did several tumbling acts close aboard.

The Intracoastal Waterway is sort of a canal-type freeway for shallow-draft boats, both pleasure and commercial. Charts and guide books covering its entire length, from New York City to Port Isabel, Tex., and across the border from Mexico

TO JUNEAU, ALASKA

JUAN DE FUCA
STRAIGHTS, SEATTLE

LEGEND

~ INTRACOASTAL WATERWAY

MAJOR AREAS OF OFFSHORE CRUISING

SAN FRANCISCO
AND
OAKLAND BAY

SANTA BARBARA ISLANDS

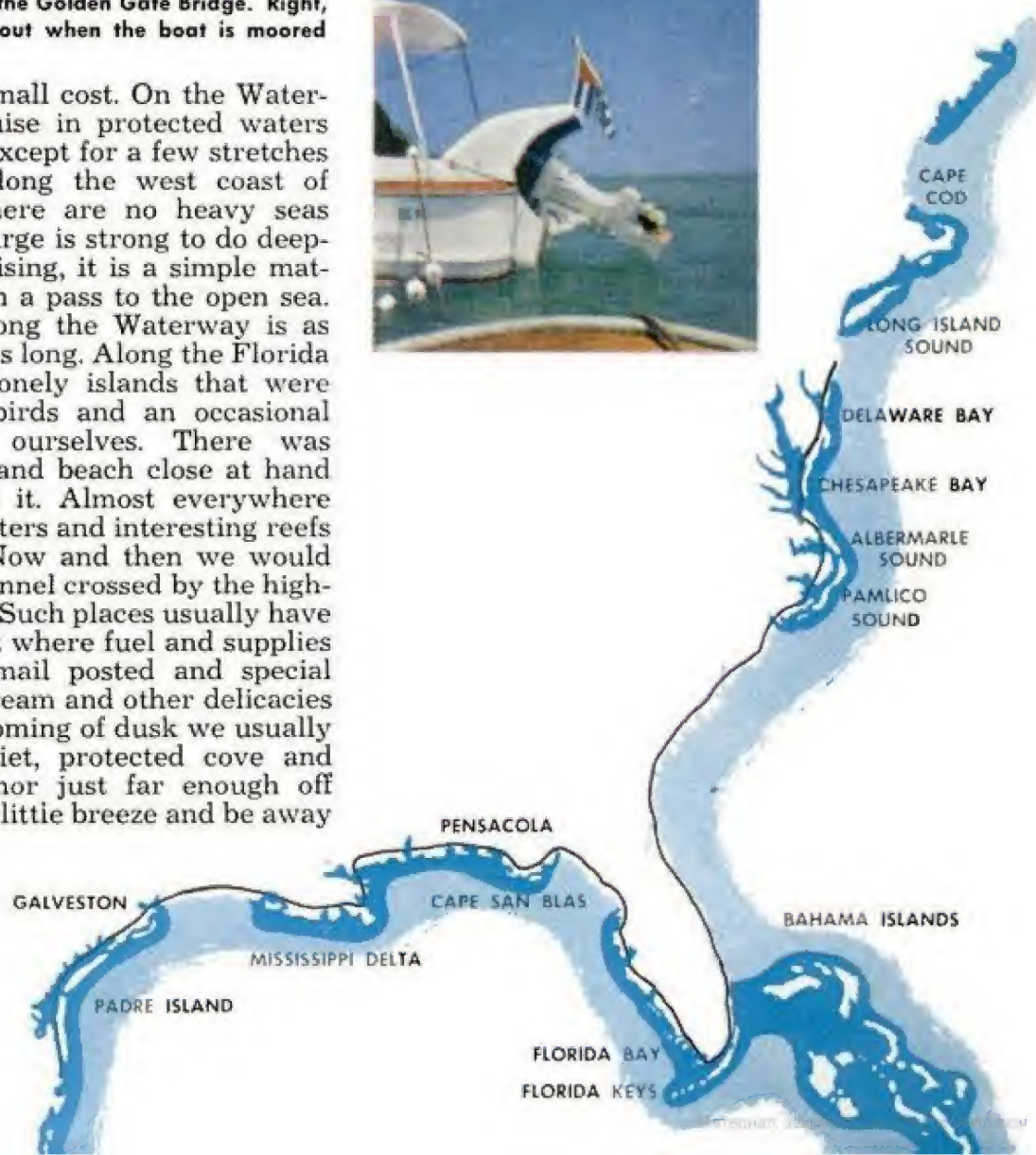
GULF OF CALIFORNIA



In another form of salt-water cruising, an outboard runabout heads under the Golden Gate Bridge. Right, lower units are tilted out when the boat is moored

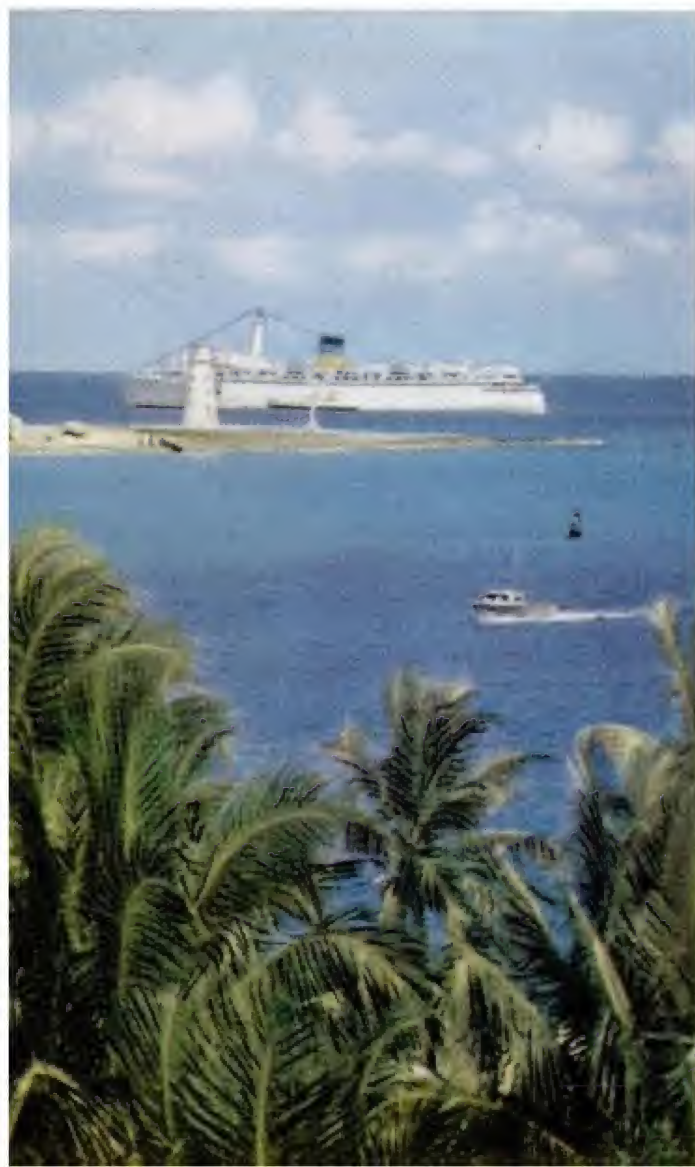
are available at small cost. On the Waterway, you can cruise in protected waters most of the time except for a few stretches of open water along the west coast of Florida. When there are no heavy seas running and the urge is strong to do deep-sea fishing or cruising, it is a simple matter to run through a pass to the open sea.

The scenery along the Waterway is as varied as the trip is long. Along the Florida Keys we found lonely islands that were visited only by birds and an occasional outboarder like ourselves. There was usually a white sand beach close at hand when we wanted it. Almost everywhere there are clear waters and interesting reefs for skin diving. Now and then we would run through a channel crossed by the highway to Key West. Such places usually have a small settlement where fuel and supplies can be bought, mail posted and special cravings for ice cream and other delicacies satisfied. At the coming of dusk we usually headed for a quiet, protected cove and dropped the anchor just far enough off shore to pick up a little breeze and be away





In offshore cruising at its best, a cruiser heads out of Nassau for a day of big-game fishing in the Atlantic



from insects. In the remaining light, the collapsible swimming ladder would be slipped in place and over we'd go for a swim in two to three fathoms of pure but "lightly salted" water. Sometimes swimming was combined with sailing in the eight-foot dinghy that we carried in the cockpit or towed when the sea wasn't too rough. The dinghy was fine for exploring narrow inlets and negotiating the shallow water found around most of the Keys islands. With a six-horsepower Mercury clamped on its transom when not sailing, explorations were never hampered because of lack of wind.

Evenings at island anchorages always started with a complete dinner, cooked by the mate on a two-burner alcohol stove. After dinner the dishes were washed and the ship's log was brought up to date, adding details to the short notes that had been entered in haste during the busy day. Except on moonless nights, there was always enough light to see the outlines of other islands in the distance and the subtle gradations of light, from the moonlit water lapping softly at the boat to shadows cast on the water by the palm trees, and finally

In a well-equipped boat you can even "go abroad" to Nassau arriving in the company of big cruise ships



Sea Joy departs from Miami, loaded for the long trip and headed toward Key West. Right, skipper installs cruise fuel tanks in the cockpit. Tanks are secured by tie-down straps which are permanently fastened to the deck. Fuel lines are concealed behind bulkheads and overboard vents are installed



the total blackness in the thick forest beyond. The raucous croaking of the overly noisy parrots during the daytime gradually gives way to a more melodious ensemble of sweeter-singing birds in the evening. Finally, all is quiet—the fresh salt air and many activities have taken their toll, and we fall asleep.

Occasionally, for a change of pace and to give the mate galley-duty relief, we would put in at a yacht club or other docking facility for the night. Docking fees at most places are reasonable. At Marathon, for one dollar, we had a well-protected dockside mooring close to town, fresh water for filling our tanks and washing down the boat and shower facilities. The friendly woman who operates Powell's City Pier, even let us use her car after telling us where to go for lobster and steak dinners and pointing out some of the local attractions. Other favorite stopovers include Travenier Key, Islamorada and Key West Yacht Club. Travenier is a bird-watchers paradise; deep sea and Keys fishing is excellent off Islamorada and Marathon and the food is superb (and inexpensive) at the Key West Yacht Club.

Shrimp boats come all the way from Galveston to fish off Key West. We were lucky to be at Marathon when some of

(Continued to page 248)

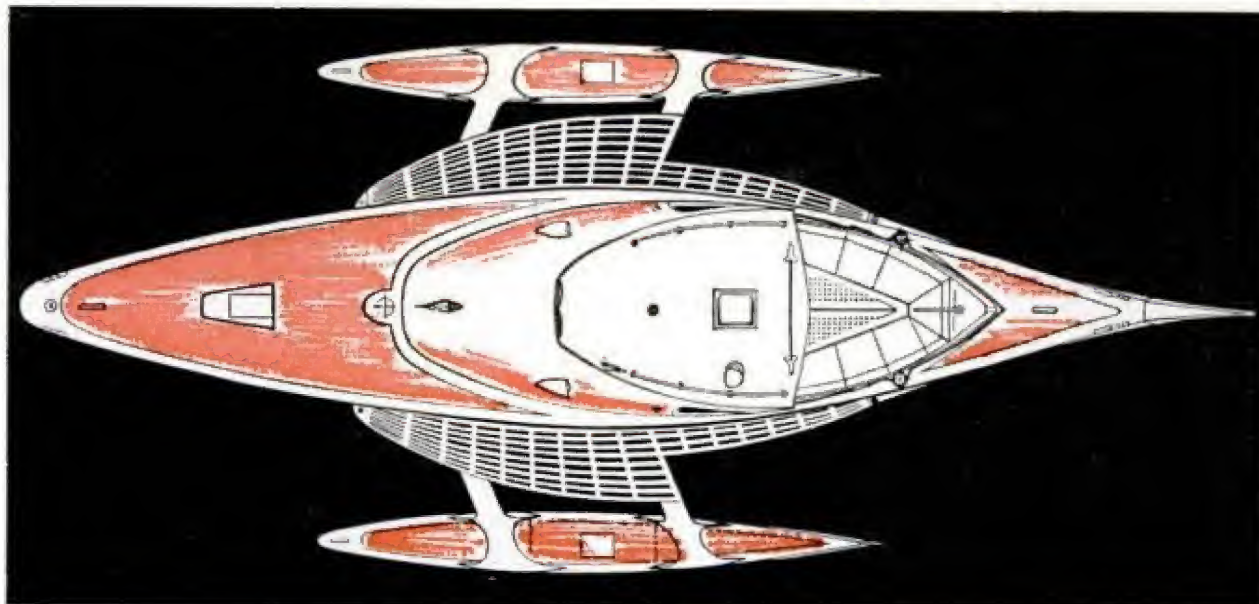
Below, radio direction finder was mounted on the forward bulkhead in the Sea Joy's head, which saw double duty as radio room. This kit-built unit also has a standard broadcast band for music and news





KOLUMARAN!

see Sept. 60, 32



No, not a space ship, but the flowing lines of *Kolu Naia's* deck plan. Stern and faired rudder are at right

Story and photos by Thomas E. Stimson, Jr.

HERE'S A NEW WORD for your boating vocabulary — kolumaran, meaning a three-hulled boat. And here's a fine example, the *Kolu Naia*, Polynesian for "three porpoises."

Designed and owned by Dean Kennedy of San Diego, a Convair aircraft engineering illustrator, the *Kolu Naia* was intended to combine the speed, stability and shallow draft of multi-hulled sailing craft with the roomy utility of a cruising sailboat. The result is shown here and on the cover.

Deck length is 38 feet; beam is 19 feet across the outriggers. The 44-foot mast supports 550 square feet of sail, designed in this unusual high aspect-ratio shape for high-speed sailing even in light, high breezes that conventional boats can't reach.

Inside, the 8 by 16-foot cabin, with 6 foot, 8-inch headroom, provides plenty of room for four sailors. The ride is a comfortable

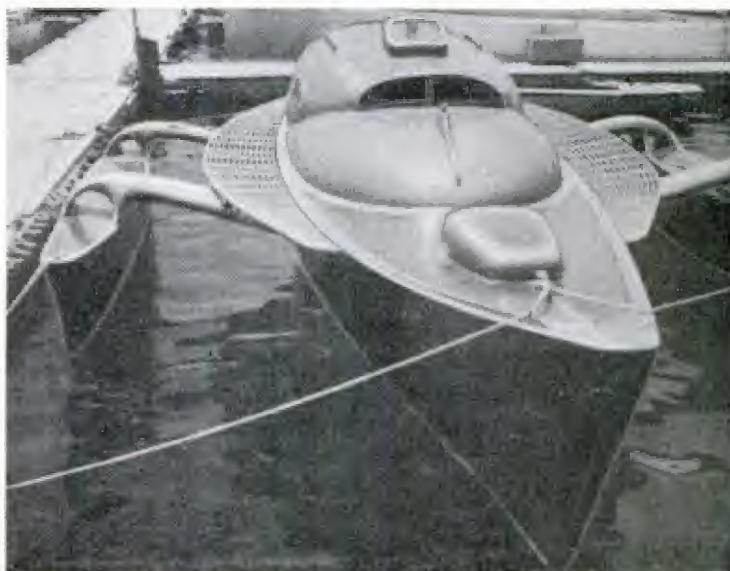
one, top, since the outrigger design keeps the craft from rolling. Tank tests show that she won't capsize even in 100-mile winds, but she sails well in light air.

Hull construction is cross-laminated mahogany plywood, covered with glass fiber, in an aircraft-style construction, which puts the strength in the skin and minimizes heavy internal bracing. The sails shown here are working test shapes of Mylar plastic; later sails will be Dacron.

The whole project boils down to a trim sailboat that'll go anywhere with its eight-inch draft, slide through surf and over beaches, ride a trailer, and scoot along at 25 or 30 knots with the right wind.

Kennedy plans to market a 26-foot scaled-down version, the *Kolu 26*, in plan form for backyard construction, and regards this as the first of a long line of kolumarans. ★ ★ ★

Left, photo and sail plan both reflect the unusual high aspect-ratio sails and tall, gaff-topped mast design. Clean design cuts water resistance to a minimum; boat here is ghosting along at 12 to 15 knots, but leaves only a riffled wake. At right, dock view shows molded glass fiber cabin trunk and topsides. Mast and outrigger spars are box spars covered with glass fiber. Outriggers have a total of seven compartments



THREE NEW BOATS FOR 1960



Cruiser Buttons Up, Sleeps Four

Canvas roof and side curtains close in the top-sides of a new 21-foot outboard cruiser. Thus the entire cockpit area becomes a second cabin. The boat sleeps two couples in complete privacy with room to spare. The head is also enclosed. The rear area can be opened for cockpit space during the day, or left covered to protect cargo in bad weather.



Boat's Wheels Retract in Water

Built-in retractable wheels, similar to aircraft landing gear, eliminate the need for a trailer with a new amphibious outboard runabout. The boat tows just like a trailer, but allows better rear vision. Launching is simple—you just back it into the water. The wheels retract hydraulically into a well that makes a seat on the inside, and hatches close tight over the well.



"Two-for-One" Boat Uses Sail or Motor

For the occasional boater who can't decide whether to buy sail or power, here's one that combines the two. A trim 15-foot outboard, it handles nicely with a 35-horsepower motor; step the jointed aluminum mast and lower the bilgeboards and twin rudders, and it becomes a snappy catboat with 135 square feet of sail. Built of one-piece molded glass fiber, its rigging breaks down and stows neatly inside the hull. The manufacturer also builds a 14-footer using the same rig.

For better boating

**TRIM
SHIP!**



Feb-1961 Boating Annual

WHAT'S WRONG with this picture? It's a typical outdoor scene in this age of family boating; a young family out for a spin. This is on Florida's Silver River, but could have been anywhere that small boats operate, which is everywhere there's water.

But something's wrong. The boat's digging in a bit too much at the stern, throwing water to the sides, and as a result it's not only losing speed and stability, but it's burning more fuel than it should. Dad neglected to be careful about loading, and the boat's heavy astern with Mom and the picnic gear and two heavy gas tanks bunched right at the rear. Sure, he could overpower the weight and plane it with twice that load, but he'd lose efficient cruising-range fuel consumption.

At right, the underwater camera shows what's happening—and what should be happening—on the bottom where it really counts. At the top, with the load badly placed astern and the motor at cruising speed, it just can't stay on a plane. Center, same load, engine wide open, it forces its way onto a plane but still throws a lot of water, a sure sign that it's not operating at its best. Bottom, back at cruising speed but with the load moved forward to the balance point, the hull cuts the water cleanly, leaving a minimum wake without the telltale side-splashing.

Trimming your boat can be more important than you think. Even with a normal load, a small improvement in trim can give more speed for less fuel, and make the boat safer and more maneuverable.

The spectacular boating photographs on these pages were made for P.M. by Bruce Mozart at Florida's Silver Springs.



Well trimmed with a load of about half its capacity, this 15-foot runabout glides easily along, wet to the waterline, at a speed of about five miles an hour. The bow enters smoothly and the wake is minimum, with the motor throttled back to an easy pace for moving away from the dock or for easing past other boats or through narrow channels. At this speed the boat does not lift, but knifes through the water, shoving it easily aside



As the speed increases, the hull soon reaches a point where water resistance forces it upward, bow first. The driver, throttling forward fast to avoid a long "mushing" period, forces the boat through this transition stage and it swoops quickly up and over its bow wave as a car rides over a smooth dip. With this boat, the bow comes up at around eight miles an hour, and it planes under this load at 15



On its feet and skimming along nicely just under 30 miles an hour, the hull is two-thirds out of the water and the motor has an easy time moving it along at an efficient three-quarter throttle. As the boat levels off at full throttle, the driver eases back on the power until the motor is running at its best r.p.m. (marked on the control unit). The boat, shoved onto its feet by the surge of power, stays up, level and steady, for a smooth ride





Heavily overloaded forward, this boat shows what happens when you reach that transitional stage and can't plane. The heavy bow can't climb as it should, so it's forced to shove water aside, wasting power and wobbling badly. (This is an exaggerated situation, of course, and most boaters know better than to ride on the foredeck, but this boat, like most modern outboards, is so inherently stable that we went to extremes to illustrate errors)



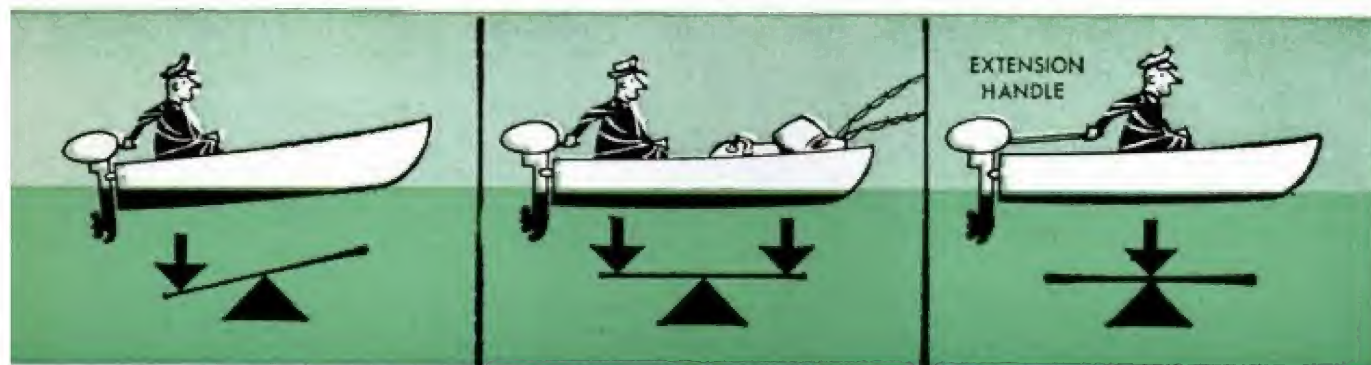
Heavy aft, the boat needs every ounce of thrust in its big 45-horsepower motor to come up on its feet. When the motor is slowed to its cruising range, the stern drops back into the water, throwing a heavy side wave and leaving a wake that would rock boats for a block in any direction. With the motor working hard enough to plane with this load, gas "mileage" drops about 20 percent and the boat tends to wobble and "porpoise" badly



Balance across the beam is equally important, but easier to maintain. If Mother would just slide over to the port side and take the portable icebox with her, this boat would level off nicely and Dad wouldn't have so much trouble getting it to plane. Underwater shot shows the uneven water resistance to a tilted hull that makes it slow and unstable. Note the school of bluegills in this underwater photo



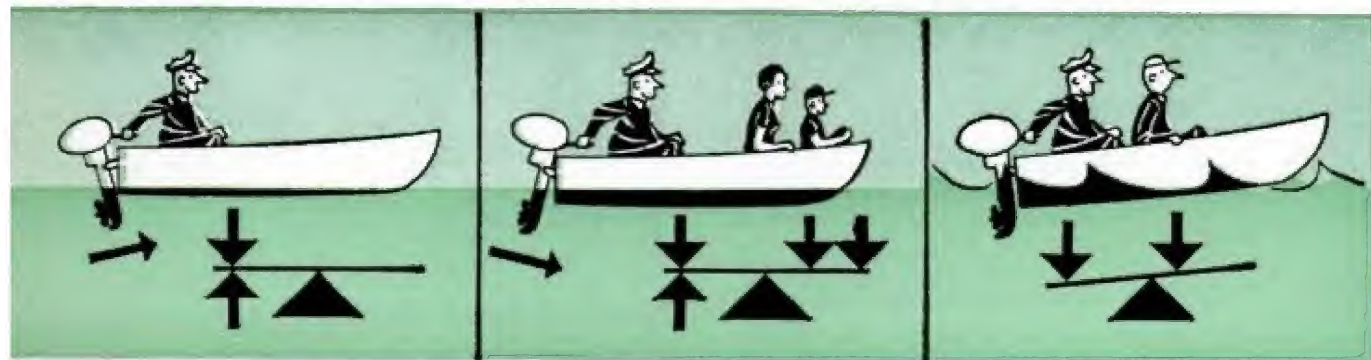
Trimming a boat is like balancing a seesaw — And just as easy if you follow these tips



Lone operator with an outboard is up against it—all the weight is behind the boat's point of balance; bow rises

But he can help if he'll move his gear and fuel tank forward to offset his weight. A few good-sized rocks can help, too

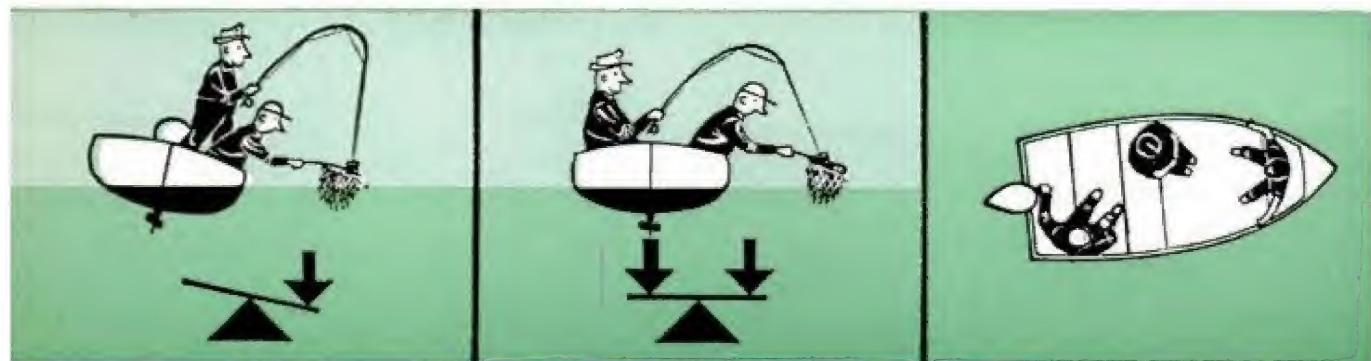
Extension handle solves the problem by letting the driver move up over the balance point but still handle the motor



Changing the tilt of the motor can help, too. Here a lone operator has moved the lower unit forward to attain upthrust

Downthrust works the same way, though not as well, by balancing a heavy bow and keeping stern down for control

Sometimes it's good sense to load off-balance. Here both men are seated well back to lift the bow over heavy waves



The same principles work across the beam. If both men stand up on the same side, they'll probably be in with the fish

If one stays on one side while his partner leans over the other, the boat stays level and the fish is easy to land with safety

Man on port side compensates for the driver, and the boat runs level. Move gear and passengers until trim and level

Several factors affect the way a boat rides on the water — trim, power, motor tilt, propeller, hull design, even wind or waves. Each boat has a basic point of balance, though, and with a little trial-and-error experimenting you'll find the best load distribution for your particular situation.

Good trim is a happy combination of all those factors, but there's no set formula for finding it. A speedometer and tachometer will help, for when it's right you'll get maximum speed for the r.p.m. you're running. Find your boat's balance and you'll have more fun—safer—for less money.

Boatman's Burden

You, Your Boat, and the Law

FORTY MILLION AMERICANS can't be that wrong—sport boating is a lot of fun. One of the big reasons for its popularity is the casual and carefree air that surrounds boating and boaters. But like hunting and other active sports it's fun with built-in responsibilities.

A pretty simple act—or failure to act—can do a lot of damage on the water, and

can land you in court or even in jail on a civil or criminal charge or complaint. Today's guest on your boat can become tomorrow's plaintiff if something goes wrong.

The principles of legal responsibility on water are very much the same as those in owning a home or driving a car, but there are some basic differences that every boat owner should know. Here are a few:

As owner, you are responsible for damage caused by your boat, not only when you're aboard but also if it's being operated by a member of your family or another person with your knowledge or consent. Laws determining the extent of liability vary widely from state to state to federal statute. In some cases the liability is limited to the value of your boat if the accident occurs without your knowledge or participation, but it's best to make sure that the boat is handled by a qualified, responsible driver. Almost any kind of misconduct in your boat could lead to a negligence charge or claim



All boats are equal under the law—there is no privilege in size, use or status when placing the blame for a collision. Though some courts handle boating accident cases by automotive standards and will allow a division of damages according to blame, others (including most inland courts) follow the doctrine of contributory negligence, which will not allow you to recover damages if your own negligence has contributed to the accident, even as little as one percent



The law charges you, as owner, with the responsibility of keeping a safe boat, and with the liability for injury or damage caused by any unsafe condition aboard. What's more, you're responsible for an unsafe condition even if you don't know about it and though it isn't visible to an ordinary inspection. Fortunately, the law also recognizes the hazards involved in boating, and requires others to exercise caution





Guests aboard, especially if they're on business, are entitled to a safe boat, and to a warning of any unsafe condition or operational hazard. Again, they must be careful, but the owner is required to protect them from themselves by preventing dangerous practices such as standing on slippery decks under way

A drifting boat, like a skidding automobile, is still your responsibility whether you're aboard or not. Start and test your motor before casting off, avoid drifting around other boats, and be sure that your mooring is secure enough for any weather that might be expected to arise while you're gone or asleep



You must keep a proper (and qualified) lookout in every direction from which trouble might be expected to arise. A stiff neck won't be a valid excuse if you dawdle in front of a big boat that can't stop or turn quickly, and your failure to look behind you could be called contributory negligence if it runs you down



Failure to comply with federal, state and local laws for identification and safety equipment could get you in trouble if an accident resulted from your failure. Check the regulations and be sure to have the proper markings and the required lights, signals, fire extinguishers, and Coast Guard-approved life preservers



Learn and observe the "rules of the road"—but remember that whether you have the right of way or not, you are required to do everything in your power to avoid a collision even if the other boat is obviously in the wrong. Boating law is based on common sense; it works best if you supplement it with courtesy

Operating or mooring your boat in such a way that it interferes with navigation is not only very bad manners and a dangerous practice, but is a violation of most boating laws. Moor your boat in an out-of-the-way place, away from channels or bridges and never where other boats must maneuver to pass yours



On strange waters, check the local regulations for speed and power limits, restricted areas and other pitfalls before starting out. Boating laws are usually quite liberal, but a simple thing like the local definition of the word "dangerous" could make a big difference, especially when you're boating with strangers



If you are in a collision, you must render aid to the other boat and its occupants whether you're at fault or not. If you are present but not involved, by all means render what aid is needed, but be careful, or your carelessness could add to the damage. Hit-and-run driving is a mighty serious offense on the water

If you trailer your boat, drive accordingly and don't let a smooth-pulling modern trailer lull you into forgetting it's back there. Since local and state laws vary widely on speed limits, light and signal requirements, and handling laws, take time to check near your entry point before trailering across a strange state



Qualify yourself for safe boat ownership and stay out of trouble the easy way by learning the rules first. You should be familiar with your local and state laws, the Motorboat Act of 1940, the Federal Boating Act of 1958 and the Coast Guard Regulations. And while you're at it, teach your family these laws, too

Whether your boat is a 16 or 61-footer, it's a good idea to have insurance—not only hull coverage, but liability insurance as well. Homeowners with small boats may be covered by their homeowner's liability insurance—check your policy to find out. Boating protection, in most cases, can be purchased at small cost



Cartoons by John Bolt

The U.S. Coast Guard has published an excellent pamphlet with the highlights of the federal statutes and Coast Guard Regulations, plus a collection of safety suggestions for the small boat owner. To get a copy, contact the nearest Coast Guard Group Office, District Office, or Marine Inspection Office, or write the Coast Guard at Washington 25, D. C. Ask

for pamphlet CG-290, *Pleasure Craft*. It's free.

Copies of the Outboard Boating Club's *Digest of State Boating Laws* and *Digest of State Trailer Laws* are available to the public through the OBC's free library. For copies or for a list of the subjects available through the library, address the Outboard Boating Club of America, 307 North Michigan Ave., Chicago 11.

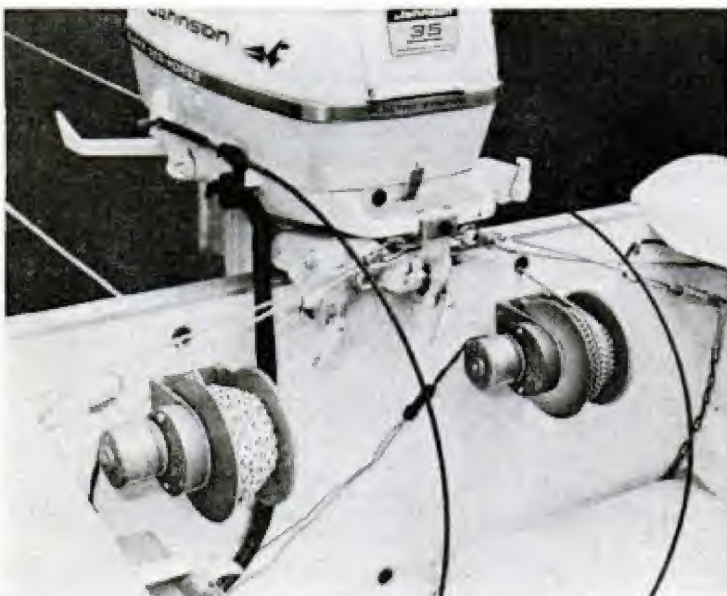


NEW FOR YOUR BOAT

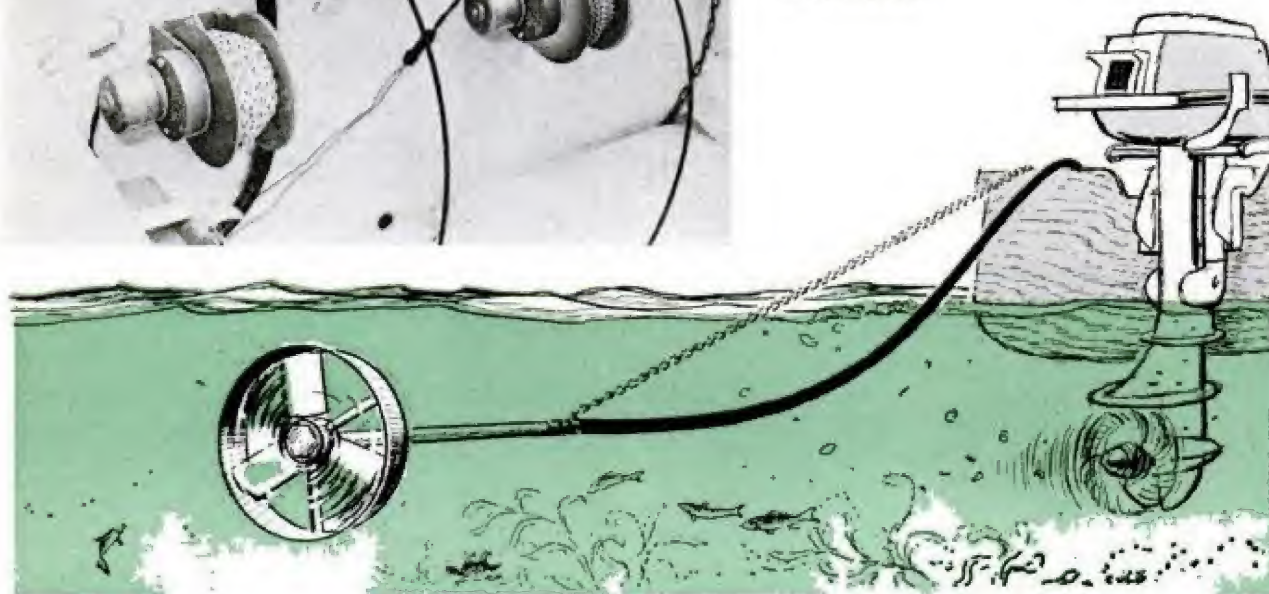
Cockpit seat cushions, thrown from the boat and snapped together in the water, make a four by eight-foot emergency raft. Made of two-inch vinyl sponge covered with plastic, this set could float a dozen swimmers.



Overboard fuel tank doubles as a flying transom and adds planing surface while removing gas and gas tanks from the cockpit. The glass-fiber tanks are available in 37, 65 or 85-gallon sizes; come with a complete mounting kit.



Motorless bilge pump, below, operates on boat's forward motion; pumps two gallons a minute from any moving boat. Spinning impeller siphons water out through screened intake. All plastic and brass, the pump is noncorrosive in salt water.



PM Reports on

The JET BOAT



Flat out, the Turbocraft water-jet boat scoots along near 40 miles an hour. A lot of inboards will do that, but this one could be doing the same thing in three inches of water or through white-water rapids

By Dick Kirkpatrick

BILL HAMILTON and John Buehler are out to change the boating business — and they may very well do just that. Hamilton, a New Zealand inventor and industrialist, has developed a practical water-propulsion unit for small boats; Buehler, president of Indiana Gear Works, Inc., of Indianapolis, is building the units in this country and causing a lot of comment, for the boat, the Buehler Turbocraft, does things that no other boat will do, and in some cases does them faster, safer, and more efficiently for less cost than conventional inboards.

Basically, Hamilton's jet unit works under Newton's First Law of Motion, which says that for every action there is an equal and opposite reaction. When the jet unit shoots a stream of water out the back, the boat goes forward—fast.

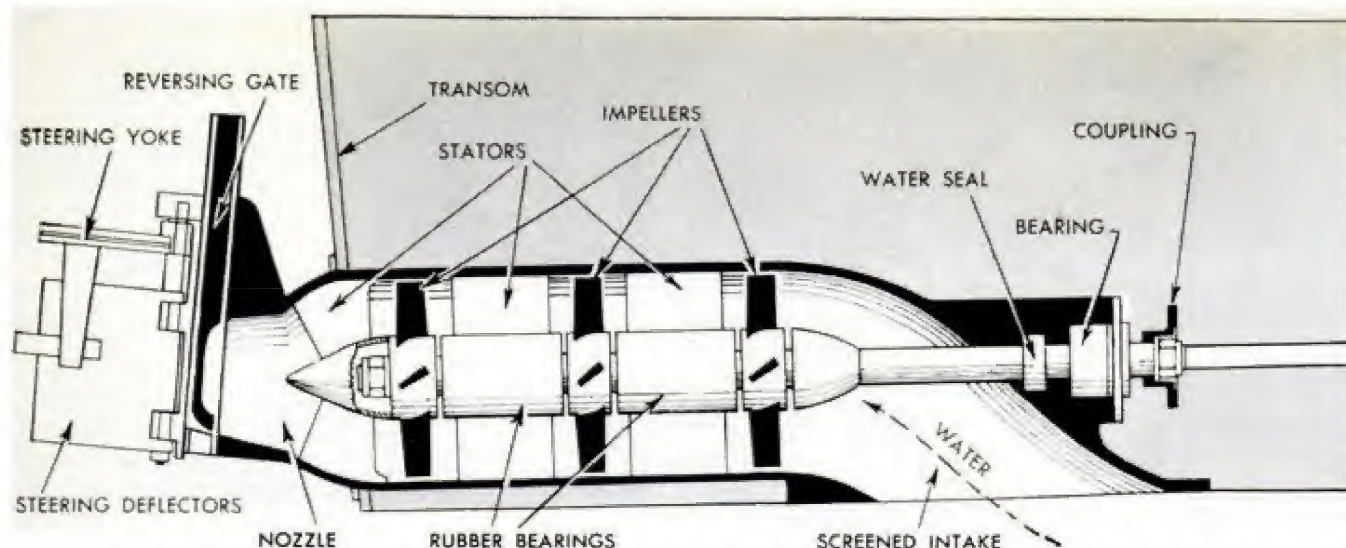
But the biggest advantage to the boater is that the boat needs no propeller, rudder, or underwater appendages of any kind. As a result, it needs only enough water to float the hull to operate at full efficiency. Since it slides over rocks, through brush, over weedbeds and sandbars, it can operate

in water that even an airboat can't navigate.

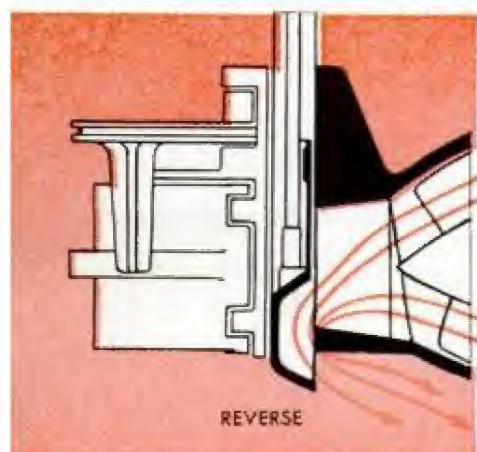
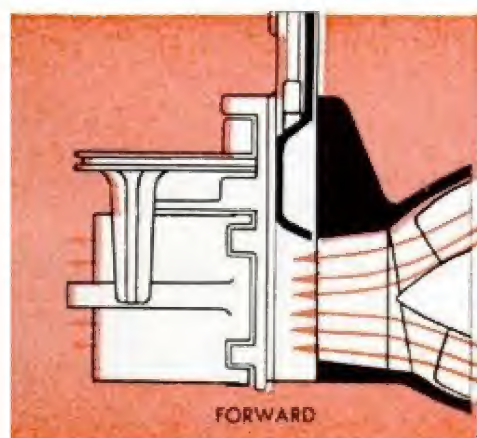
Imagine what that could mean to a family living in, say, Kearney, Neb., where the Platte River is "a mile wide and a foot deep." Hundreds of miles of water that defy conventional boats are open to a boat that can be launched in ankle-deep water, runs in less than that, and is almost impossible to hang up on an obstruction.

Maneuverability is great, too, since there's nothing under the hull to trip the boat in a turn. Test drivers have never been able to spill it, even in the most violent maneuvers. It even has brakes—you can throw the motor into reverse at any speed, and stop the boat almost within its own length from full speed.

All that and efficiency, too. Using standard inboard power, the Turbocraft will operate at about 30 percent less cost than a comparable outboard; 10 percent less than a propeller-driven inboard. The boat sells somewhat higher than comparable inboards, but offers compensations by opening water that's never been boated, from Florida swamps to Washington rapids.



Above, the basic works of a Hamilton water-jet unit. Water comes in at right through a half-inch grid, passes through turbine and shoots out between the steering deflectors at left. Reversing gate here is in neutral position; drawings below show forward and reverse positions. Bottom photo shows exterior view



IN OPERATION, the jet unit works like an axial-flow pump, sucking water in through the intake under the hull, running it through three sets of impellers and stators, then out the nozzle. The third stator is reverse-twisted, so the flow is straightened to avoid torque or unnecessary spray. Crammed by the turbine through a narrow nozzle, the jet flow bursts out at around 65 miles an hour, generating about 750 pounds of thrust and moving 2250 gallons of water per minute. On the way out, the stream passes between two steering deflectors, which take the place of a rudder and steer by deflecting the stream to either side. There is no transmission. The unit has a reversing gate which is up out of the way during forward motion, drops down to close the nozzle for neutral, and directs the jet flow back under the hull for reverse thrust (see drawings) above and left.

Three power combinations are currently available on the production model Turbocraft, a 16-foot runabout. They are a 107-horsepower Ford six, a 109-horsepower Graymarine six, and a 135-horsepower Interceptor V-8 which gives the boat a top speed just under 40 miles an hour. Efficiency falls off with the 135-horsepower engine at full throttle, so future designs with higher power will probably use dual turbines. Another future Turbocraft will use a two-section turbine and 25-horsepower engine in a 12-foot boat for light utility and sports use. It should do around 23 miles an hour on the smaller boat.

The first ride in a jet boat is quite an experience. Acceleration is smooth but very fast—up to a plane in about two boat lengths. The jet unit comes out of the water as the boat comes up, but the spray isn't bad unless the acceleration is extreme, and the above-water jet is the secret behind the boat's performance. Steering is very light, since there's no rudder, and the deflectors provide a self-centering effect that's similar to the caster action of your car's front wheels. Controls are standard, with a foot throttle and a simple hand lever for controlling the reversing gate.

The Hamilton jet unit is not available separately. Technical problems would make installing your own a tough job, anyway, but the units are being installed by other boat manufacturers in the East, West, and South under license from Indiana Gear Works.



EVERY BOATER'S first question about any new boat is "What'll it do?" This one does a lot of things, mostly spectacular, but all with a hard practical purpose. Here, from top to bottom, it turns inside its own length at low speed; then turns in a tight circle at 40 with no danger of spilling. It runs through rapids and rocks with gay abandon, since it'll survive any knock that doesn't hole the hull, and the glass-fiber hull is plenty tough. It'll plane through less than three inches of water and run in water too shallow to float the hull. And it'll bust through brush that would stop any other craft on the water, simply because there's nothing to hang up—and plenty of brute thrust to push it. One freak can stop it—flat-leaved weeds or lily pads can plaster themselves over the intake at very low speeds, but a quick blast in reverse will blow them away. Anything small enough to get through the intake grid simply passes on through the turbine and goes out the nozzle. The boat looks and sounds like any other inboard runabout, and rides the same, but there the resemblance ends. Its spectacular performance puts the Turbocraft in a class of its own.





SINK-PROOF YOUR BOAT

By Earl Wobeck

WILL YOUR BOAT sink or remain afloat if it springs a bad leak or capsizes? If you don't know, it will be well worth your while to find out and fit the boat with whatever amount of additional flotation is required to provide a comfortable margin of safety. Although most manufactured boats have sufficient flotation for normal load conditions, it would be prudent to offset the weight of any unusually heavy equipment added to the boat with buoyant material to float it. This may be done by fitting foamed plastic, such as Styrofoam, in unused spaces as in Fig. 1.

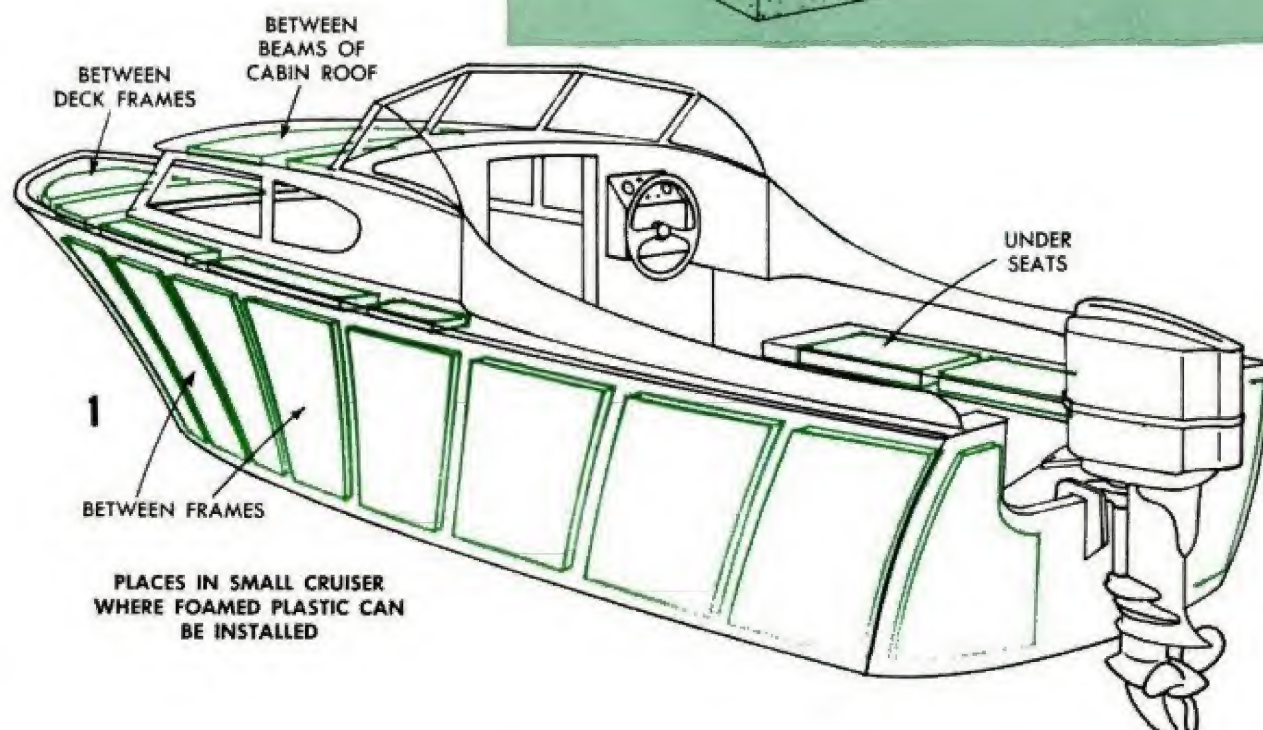
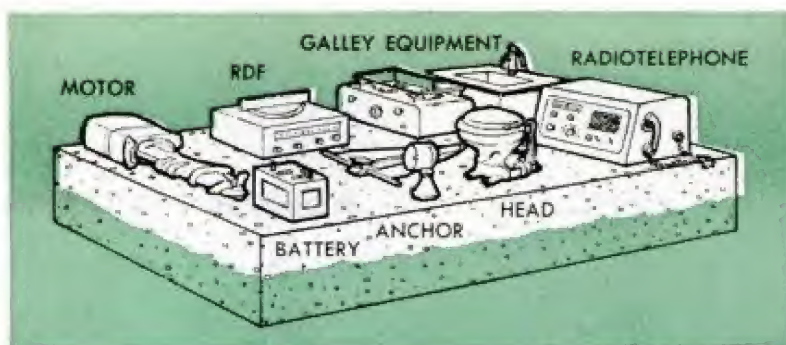
Foamed plastic is filled with countless air spaces, each one separate from the others. It will not deteriorate from normal exposure; no amount of mechanical damage will affect its buoyancy, and it is very easy to shape, permitting it to be owner-installed in any accessible place. Cost is quite small, about \$2.00 per cu. ft. at marine-supply stores. Air tanks, or sealed air spaces are not recommended since they may develop leaks due to accidental damage or deterioration of the container. If this occurs unnoticed, the owner is unaware that his boat has lost its ability to remain afloat in the event it is swamped, although

it may submerge slowly or possibly not at all, if the above-water portions of the punctured air chambers remain airtight.

The primary concern of this article, is the boat that has not been provided with flotation, be it manufactured, or the home-built variety. Wooden boats are not excluded since they become waterlogged to a certain extent when in use. Also, some types of wood, such as oak and certain mahoganies, have a very low buoyancy factor. Hulls constructed primarily of these woods have much less buoyancy reserve than do those made of cedar, one of the most buoyant of native boat-building woods. Resin-coated glass fiber has no positive buoyancy. Boats using it as a primary material, require much flotation.

There are two foolproof ways of determining the amount of flotation required to make a boat unsinkable. One method involves application of weight capacity and flotation formulas developed by the Boat Engineering Committee of Outboard Boating Club of America. While these formulas are recommended practice for commercial boat builders, home craftsmen are encouraged to use them. Anyone who is familiar with high-school mathematics can

To make your outboard cruiser unsinkable, total the weights of equipment, maximum number of passengers to be carried by boat, and the hull weight, if glass fiber or metal. Then divide by 55, number of pounds 1 cu. ft. of foamed plastic will float, and install this amount as shown



2. Below, after outlining the shape of foamed plastic to fit space in boat, it is cut with handsaw



3. Below, plastic board is positioned under deck so it can be marked for trimming to deck curvature

Photos courtesy Dow Chemical Co.





4. To ease job of filling space under seat with foamed plastic, three pieces are used instead of one

apply the formulas to any boat, but not without considerable work. A copy of the formulas may be obtained from O.B.C.

A much easier, less precise method, but one which will do the job just as well, requires that you simply total the weights of all nonbuoyant equipment attached to your boat and divide this figure by the number of pounds 1 cu. ft. of foamed plastic will float (55 lbs. in the case of Styrofoam), inset, Fig. 1. Weights of items that can't be placed on a scale usually can be found in marine-supply catalogs or manufacturer's specifications. If the boat is of wooden construction, disregard the small items of hardware, such as cleats, running lights, etc. For glass-fiber and metal boats, include the weight of the hull as well, unless there is enough wood attached to float the bare boat. Don't forget to add the approximate weight of the maximum number of passengers to be carried.

At this time it is a good idea to make sure that the boat is not being overloaded with equipment and passengers. If the load or weight capacity of the boat is not given by the manufacturer or designer, here is an easy way of determining it. Block up the boat so that the water line is level. Then remove equipment that might be damaged by moisture and fill the hull with



5. When screwed in place, bottom and back of seat hold plastic and protect it from possible damage

water as in Fig. 6, noting the gallons required to bring the water level inside the boat up to the transom cutout. Multiply the total gallons by 231 (cubic inches per gallon) and divide by 1328, which will give the hull capacity in cubic feet. The latter divided by 12.5 is the maximum weight of passengers and equipment that should be carried in the boat. If your intended boat load exceeds this figure, carry fewer passengers, install lighter equipment, or use a smaller motor to stay within the limit.

Having determined the amount of flotation needed for your boat, note the dimensions of the spaces in which foamed plastic can be installed. Foamed plastic is available in plank and board form, so you will want to purchase sizes that will best suit the spaces available. Use the blue-tinted type that is fire resistant and order the amount needed plus 20 percent to allow for waste when cutting it to fit.

Try to get a balanced distribution of flotation, keeping it as high as possible to prevent the boat from overturning when swamped. More flotation is needed at places where heavy equipment is installed. Gas and oil will dissolve Styrofoam, so don't locate it in the bilges.

Foamed plastic can be cut easily with a handsaw or knife. Using a crayon, outline



6. Boat is filled to transom cutout with measured water, as means of determining load capacity of hull

the required shape on the plastic and saw it off as in Fig. 2. When installing a large piece on the underside of a deck, Fig. 3, some extra shaping is necessary to make it fit flush. The top must be trimmed to conform to the curvature of the deck and notches made to take the framing members. In a runabout, large pieces can be located under the seats and behind the rear-seat back, Figs. 4 and 5. Note that multiple pieces are used so that the spaces can be filled completely. In this case, the material

is not notched at the bottom to take the battens on the hull bottom, keeping it out of the bilge area.

Foamed plastic must be fastened down regardless of where it is located. In most cases, a batten or sheet aluminum strip clamped over the material will do. In exposed places it should be boxed in with $\frac{1}{4}$ -in. plywood to protect it from surface damage as in Fig. 7. It may be painted, but use only coatings recommended by the foamed-plastic manufacturer. ★ ★ ★

7. Foamed-plastic piece located next to motor-well bulkhead is boxed in with protective panel of plywood





Arkansas Traveler photos

1961 Boating Annual ✓ TRAIL IT RIGHT!

By Scott Morgan

WHILE TOWING A TRAILER loaded with a heavy boat is an easy job for most modern cars, even when traveling long distances, the boat itself may not get through the season unscathed. Incorrect loading, or a trailer that is unsuited to the boat may result in damage to the finish, warped bottom, loose transom, or even a wrecked trailer and boat. While the repair of such damages often is difficult and costly, prevention is quite easy.

Taking first things first, let's consider the suitability of the trailer you have or intend to buy. Of primary importance when buying a boat trailer is to be sure the capacity as rated by the manufacturer, exceeds the weight of boat and everything

that is to be hauled on or in it. A trailer with a load limit that just equals the total weight of boat load, is too small. In use, tires may blow, welds break, launching and retrieving will be difficult and it is likely to give a "mushy" feeling when maneuvering in highway traffic.

Almost as important as load capacity, is the design and provision of supports for the boat hull. Make sure that the trailer you buy has an adequate number of keel rollers and husky stern and bow cradles or bunks, Figs. 3 and 4. These should be located so that there is a balanced distribution of support points, otherwise unsupported parts of the hull may develop unflattering curves, especially where there are major concen-

1. While skipper winches boat on trailer, "first mate" uses stern line to prevent it from being blown sideways

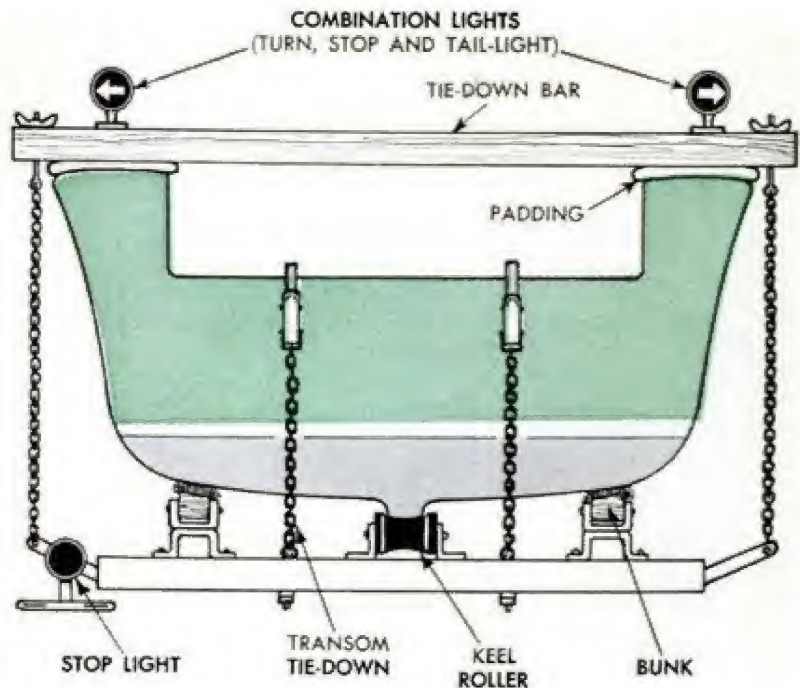




2. For long trips padding is placed under tie-down strap at sheer to prevent strap from marring finish

trations of weight. In addition to making it easy to roll the boat on or off the trailer, keel rollers bear much of the weight of the boat. Stern bunks and bow cradle support the outboard parts of the hull and keep it upright.

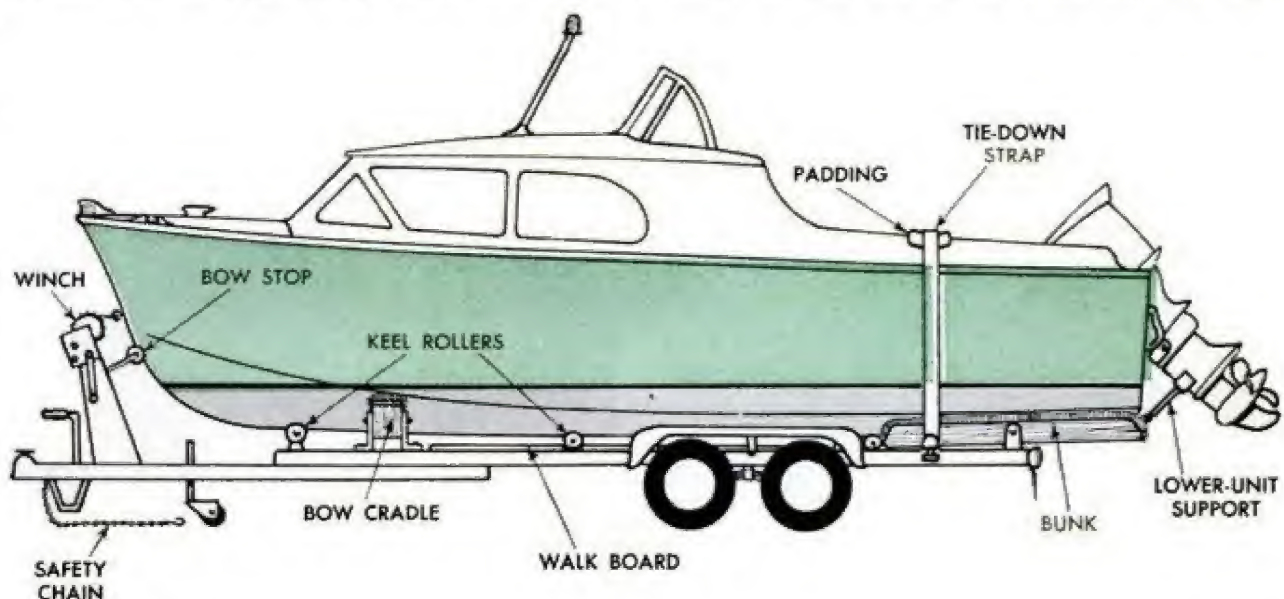
Since the support members on a trailer usually are adjustable, a session with a wrench the first time the boat is loaded on it will assure proper hull support. Keel rollers should be pushed firmly against the keel of the boat and tightened in place as in Fig. 7. Next the winch stand is loosened and moved so that the bow stop contacts



3. Equipment for securing afterend of heavy boat should include transom tie-downs and tie-down bar

the stem, after which it is tightened down. The bow cradle should be checked to be sure that both sides are in contact with the bow. If it cannot be adjusted to fit the bow, correction may be obtained by remounting it slightly aft, or by fastening facing strips on the cradle to give the required angle. Stern bunks must be adjusted vertically to fit tightly against the hull bottom and be moved horizontally so that the afterend of each is flush with the outside of the transom. If the bunks do not support the transom, the weight of the motors will be supported at a point where the hull has no

4. Boat must be supported by rollers and bunks on trailer at close intervals to avoid strain on hull





5. Scissors jack, tire-patching kit and pump, lanterns and wrench to tighten hitch are carried for emergencies

structural members, which may cause a "hook" or concave surface on the planking. A hook produces an adverse effect on a boat's performance and usually is difficult to repair.

While adjustable parts permit some "tailoring" of a trailer to fit a boat, don't try to trail a 20-ft. cruiser on a trailer that was designed for a light runabout. Remember the weight-capacity requirement.

6. Last step in loading boat for trailing is to connect trailer lights to car's electrical system, being sure they operate correctly before driving off



After you have fitted your trailer to the family "ark," or sleek runabout, as the case may be, the next step is to install a stout hitch on the car, if you have not already done so. The hitch should be attached directly to the car frame for safety. Cruisers and other heavy boats require a 2-in. ball; 1 $\frac{3}{8}$ in. for boats weighing less than 1500 lb.

The next consideration is tie-down equipment. For lightweight boats and short trips with heavier boats, a tie-down strap is sufficient for securing the stern end to the trailer. For long trips with a heavy boat, a bar should be used as in Fig. 3. In either case, it is wise to place padding between the tie-down and deck to prevent chafe as in Fig. 2. When fastening a bar in place avoid unnecessary pressure, as this can force the hull out of shape. At the bow, a heavy shock cord is tied to the bow eye and secured to the winch stand. Leave the winch line attached but remove the handle to prevent wear on the drum. To provide positive security when making a sudden stop, transom tie-downs should be installed and clamped in place as in Fig. 3. Motors that are carried any distance on the transom should be held in tilted position by a lower-unit support bracket as indicated in Fig. 4. This prevents the propeller from striking the pavement on an uneven road and reduces the strain on the transom.

Trailer lights are important for night driving, not only for common-sense safety but to meet the requirements of the state traveled. For a quick check on required lights and other regulatory data, write Outboard Boating Club of America for their "Digest of State Boat Trailer Laws."

7. Roller that does not contact keel is moved up against hull so that it shares important job of supporting outboard motors mounted on transom of boat





8. At each service stop trailer-wheel bearings are checked for overheating by touching hand to wheel cap

Minimum lights should include a combination tail, stop and directional light on each side at the back of the trailer where they can be seen easily by overtaking traffic. The lights, of course, are operated by the car's electrical system, which is coupled to it by means of a connector as in Fig. 6.

Changing a tire out on the road requires a few special tools, Fig. 5. You need a scissors jack to raise the wheel off the ground. A large adjustable wrench is needed for tightening the hitch-ball nut and other nuts that may have worked loose. A tire-patching kit and pump may save the day when you have a flat and no spare is available. Combination-light lanterns provide good illumination and safety when changing a tire at night. On-the-road repair can be kept to a minimum, if the

trailer is maintained properly and most likely trouble sources are checked at service station stops. When checking tire pressure, touch your hand to the wheel cap, Fig. 8. If it is overly hot, the bearing may be defective or be in need of grease.

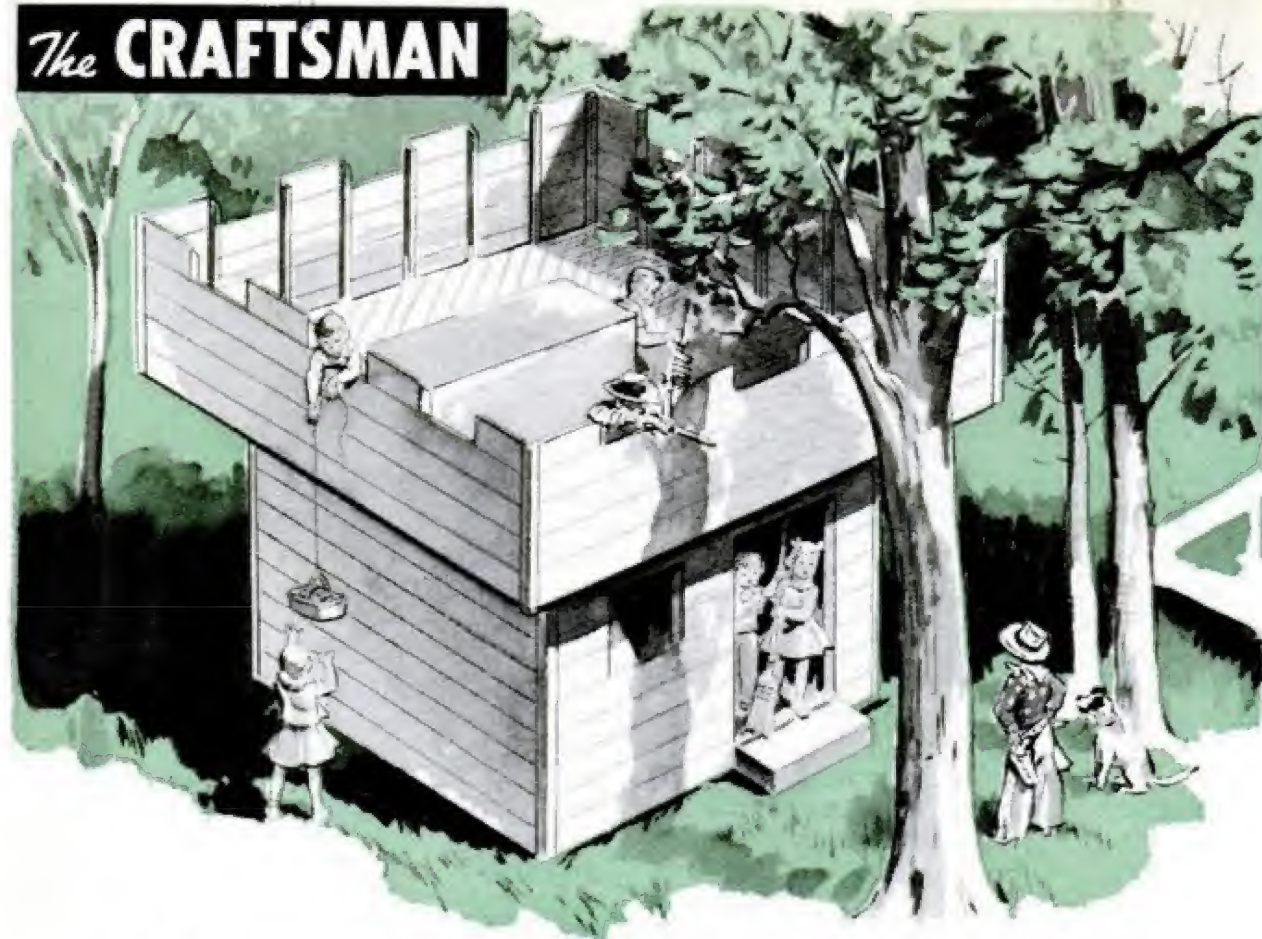
Loading and launching usually is a simple operation, but it is important to use precautions here, too. On windy days, or when a current is running, have an assistant hold the boat in alignment with the trailer until it is completely launched or loaded. A good way of doing this is to fasten a stern line to the upwind or upstream side of the boat as in Fig. 1. Winches, stabilizer rollers and walkboards, Fig. 9, take much of the work out of launching and take it easy on your boat and trailer. Use them properly.

★ ★ ★

9. Walkboard on modern trailer permits boater to launch and retrieve craft without getting feet wet



The CRAFTSMAN



Garden Tool Shed Combined With Play Fort

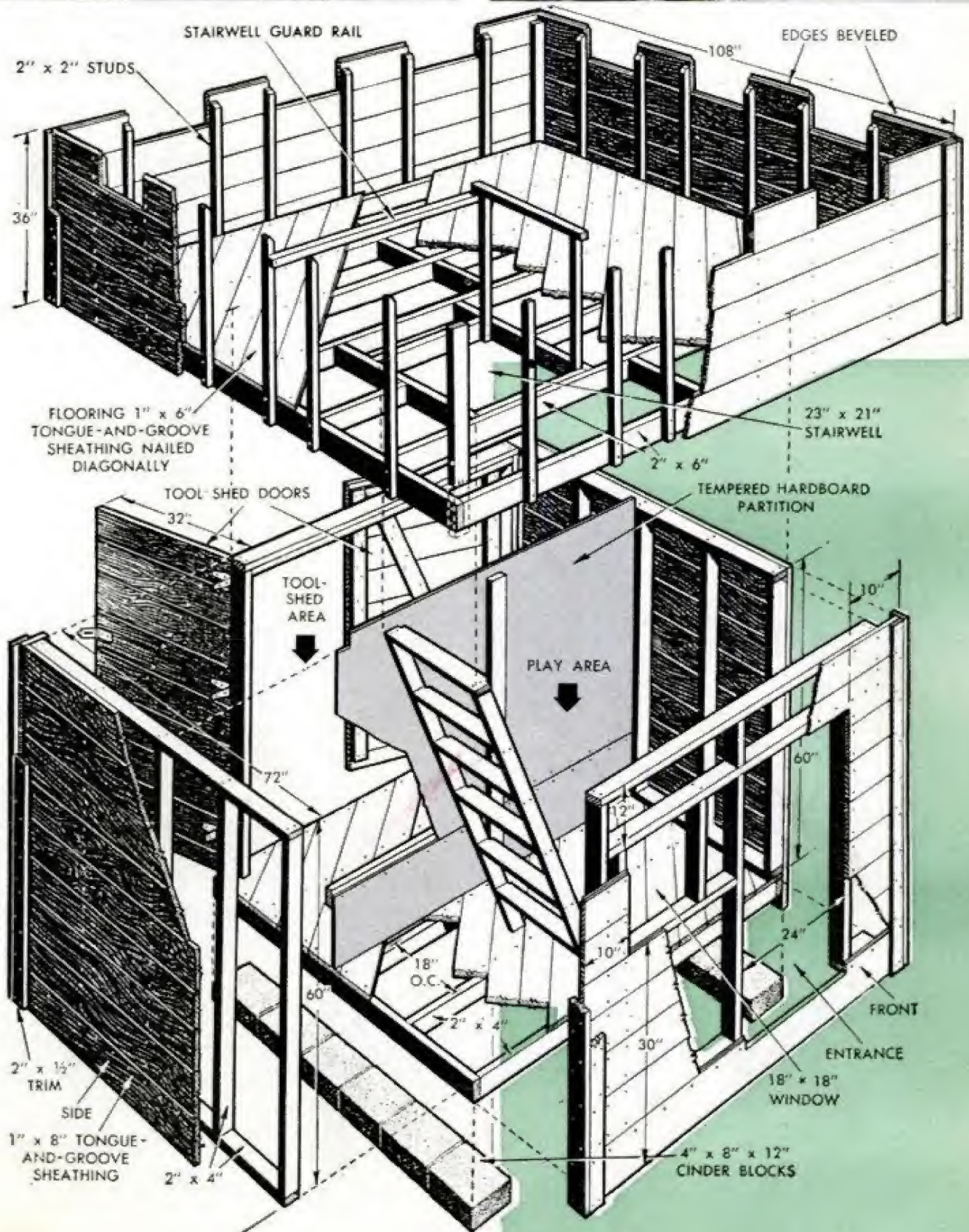
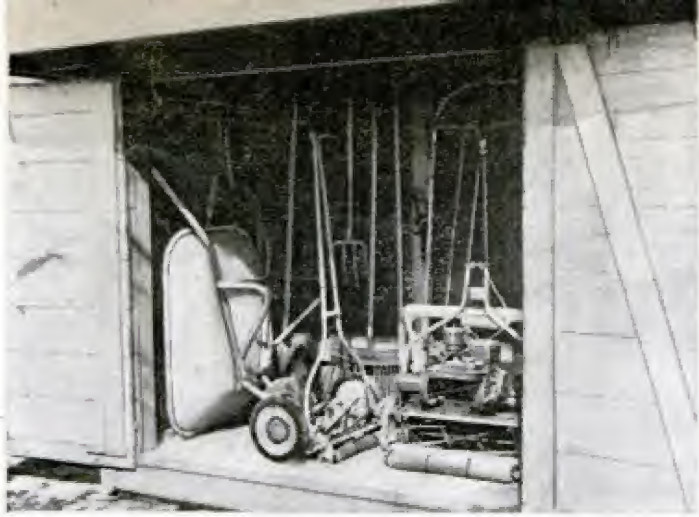
DESIGNED AS A combination playhouse and tool shed, this sturdy back-yard fort uses simplicity of construction with no sacrifice in strength or interior space. Begin making the fort by laying a cinder-block base on which to set the frame. The frame for the lower section is made entirely of 2 x 4s secured with simple face-to-face or face-to-butt nailing, requiring no complex cut-out joints. When the frame is completed, the flooring, 1 x 6-in. tongue-and-groove sheathing, is nailed diagonally to the floor joists. Before adding the siding, a partition in the center of this lower section is added to divide the playhouse from the tool shed. By dropping the center member of the partition 24 in. from the floor, one 4 x 8-ft. sheet of tempered hardboard can be cut to suffice for the entire job.

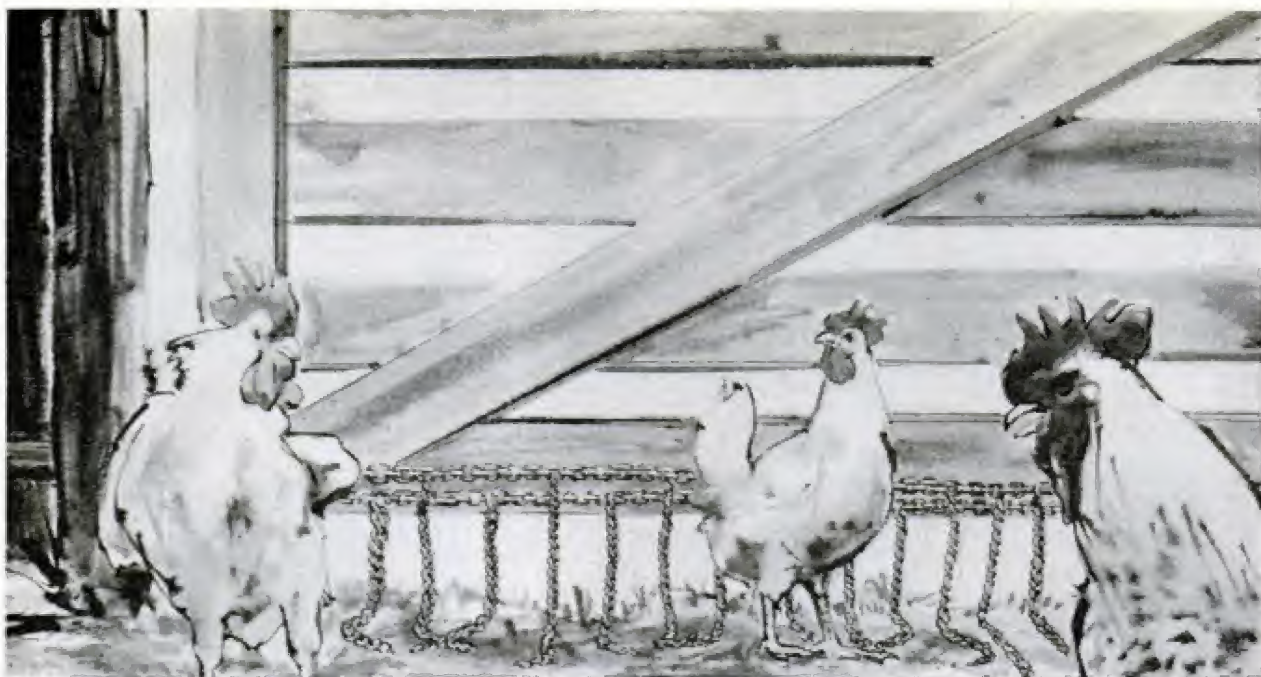
The lowered member also serves as a guard against which lawn mowers, wheelbarrows and other equipment may be run without danger of puncturing the hardboard. Doors for the tool shed are simple frames made of 2 x 4s and covered with 1 x 8-in. V-bevel tongue-and-groove siding, the same siding that is used to cover the rest of the fort. Hang the doors from 4-in. strap hinges screwed to the corner

frame posts so that they swing inward to close at the center. The 2 x 4s at the sill and top plate serve as doorstops making a center post unnecessary. To complete the lower section of the fort, nail the siding to the frame starting an inch or so from the ground and working up. This will partly conceal the cinder-block base and, in appearance, help pull the fort closer to the ground. Finish the corners with 1/2 x 2-in. trim.

Begin making the upper section of the fort by nailing 2 x 6-in. floor joists to the lower frame. Lay in floor sheathing and nail a 36-in. piece of 2 x 4 to each corner. Now nail 2 x 2 x 36-in. studs all around at regular intervals as indicated in the diagram. When the siding has been added, a space will remain between the siding and the studs which will allow for drainage. The space between the 2 x 6-in. joists and the frame of the lower section will serve to ventilate both the playhouse and the tool shed. In laying the floor, allow for a covered stair well so that access may be had to the playhouse deck by means of a ladder. Cover the upper deck with linoleum and stain all exposed surfaces inside as well as out.

Charles A. Goodrum, Alexandria, Va.





Tire Chains on Gate Serve as Poultry Guard



Chickens and other farm poultry can be prevented from escaping through the ruts under a gate by using a few old tire chains. Nail the chains to the bottom of the gate so that a good portion of each one lies along the ground. The chains will serve as a continuous barrier as the ruts are deepened by rain and the passage of tractors and other farm implements.

W. D. Terrill, Oak Park, Ill.

Screening Protects Bristles Of Soaking Paint Brush

The bristles of a paint brush won't become curved and spread from resting on the bottom of a container of solvent if the brush is fitted with a support. The support may be made out of a piece of window screening cut slightly wider than the brush and long enough to be folded over the bristles and the ferrule. Allow clearance between the end of the bristles and the fold and tack the support to the handle.



Rubber Band Helps Self-Timer Snap Reflex-Camera Shutter

The springs of most self-timers are usually not strong enough to trip the shutter of a single-lens reflex camera. To give the timer a little help, use a rubber band as shown. Place it around the camera and hook it around the self-timer's arm. The pressure the rubber band exerts will aid the timer arm in its downward movement and help to trip the shutter.

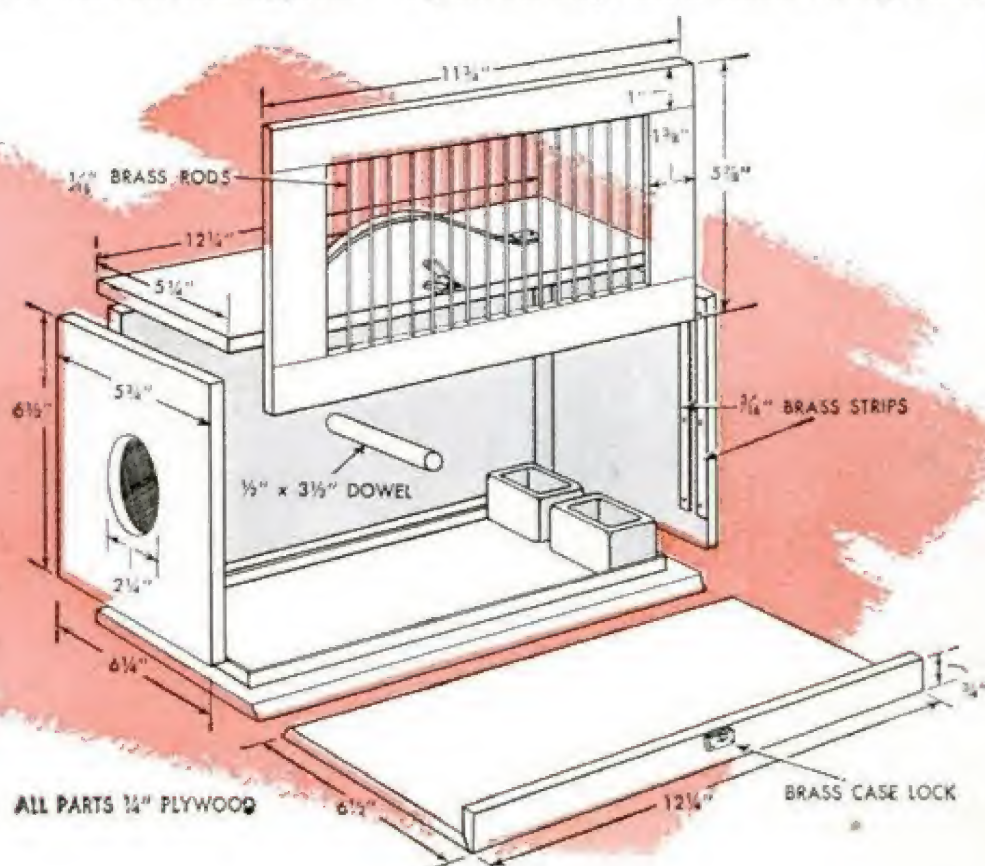
J. A. Comstock, Wellsboro, Pa.



Feathered Pets Travel in a Portable Bird Cage

THIS portable bird cage allows you to take a pet bird along whenever you travel. Cut all parts from $\frac{1}{4}$ -in. plywood as indicated in the drawing and assemble all except the front panel with brads and glue. Mount the front panel on 1-in. strap hinges at the bottom. It is locked shut at the top with a small case lock. Make the top and bottom sections of the barred sliding panel

by drilling $\frac{1}{16}$ -in. holes in a piece of plywood, and ripping it down the center. Tongue and groove the four sections of the panel, insert the rods in the holes and assemble the panel with glue. Since stain or varnish may prove fatal to your pet, cover the cage with plastic leather. Cover the air opening with wire screen, add a perch, a pull-out tray and a leather-strap handle.

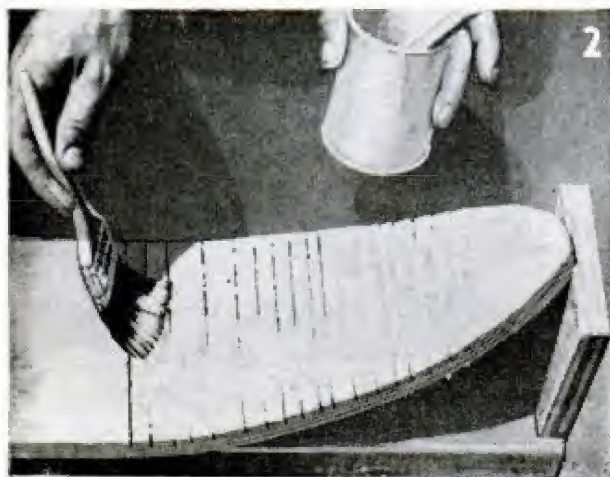
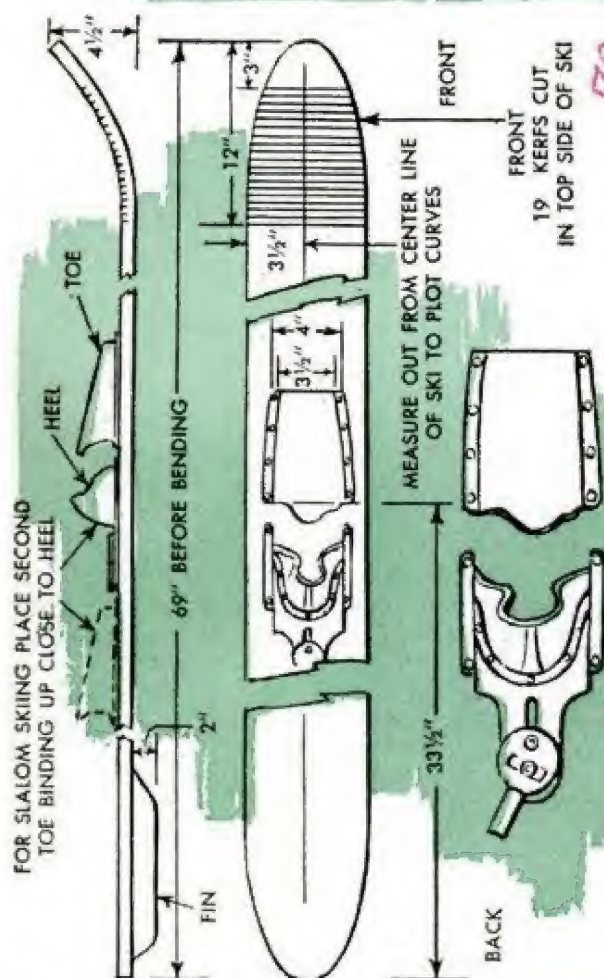




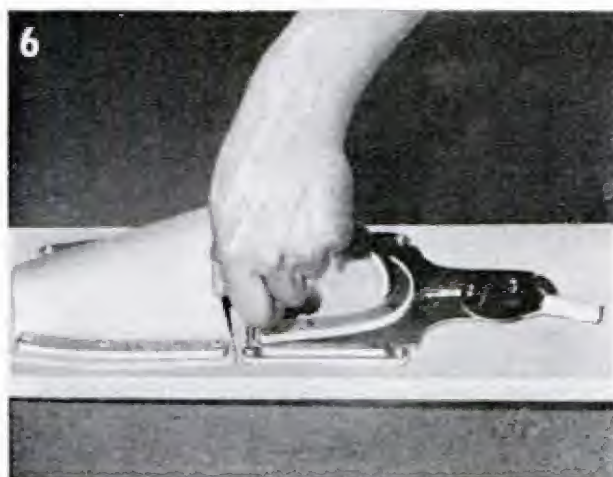
By William B. Vincent

The water skiing enthusiast who is handy with a few tools can make his own skis in a short time and know he has equipment combining beauty, ruggedness and all the versatility his skill may demand of them. The material needed to make the skis consists of a piece of $\frac{5}{8}$ x 69 x 16-in. marine-grade plywood, a piece of glass-fiber cloth measuring 36 x 40 in., 1 qt. of polyester resin with enough catalyst to activate it, and one complete set of ski bindings.

Begin by ripping the plywood into two



lengths 7 in. wide and trim both ends to the proper rounded shape. Starting 3 in. from one end saw a series of kerfs about $\frac{1}{2}$ in. apart, as shown in Fig. 1. Make them just deep enough to touch, but not cut, the last ply. The last kerf should be exactly 12 in. from the tip of the ski. A permanent bend is made by supporting the tip on a piece of wood 4 $\frac{1}{2}$ in. high, as shown in Fig. 2. Hold down the body of the ski with weights. If pressure is applied from the back forward, the stress will be more evenly distributed. As the first step in the glassing process, cut the required pieces of glass-fiber cloth to size and lay them out



in order, so that no time is wasted once the resin is applied. Most resins have a pot life (congealing or "setup" time) of less than $\frac{1}{2}$ hr. When you are ready to begin the process of glassing, mix the catalyst with the resin, using the exact proportions recommended by the manufacturer, and immediately apply a base coat with a brush or a roller. While this coat is still tacky, smooth the glass-fiber cloth on and apply a second coat being careful to work out the bubbles and to fill in any voids with resin. Before the resin hardens, trim the glass-fiber cloth flush with the ski edges as is shown in Fig. 3. The block and weights may now be removed once the resin is dry. Work may now be begun on the rest of the ski surface.

After applying a coat of resin over the entire top surface of the ski, smooth on a length of cloth, following the same procedure as before. When the resin has set, turn the ski over and repeat this process on the bottom side. Operations can be speeded up considerably at this point by working on one ski while the resin is setting on the other. To cover the large flat surfaces smoothly and to keep the resin from setting before it can be worked, stand the ski on one end and pour the resin down its length, spreading it smooth from the center with a squeegee as indicated in Fig. 4. At this point a $2\frac{1}{2}$ -in. strip of cloth is applied to the edges, so that it overlaps the top and bottom edges by about 1 in.

The fins may be either screwed on or they may be laminated into the ski. Fig. 5 suggests how they may be laminated using two layers of cloth on each side, set with resin to hold them in a vertical position on the center line. If ski jumping is anticipated, it is advisable to use two fins 1 in. high, set 2 in. on either side of the center line. Two fins are recommended so that when the ski hits the water, the impact will not cause it to tip and throw the skier off balance. Skis made according to the design indicated in the diagram are fine for slalom (using one ski) and for the conventional style of skiing.

Before adding the bindings, sand the entire ski and add one last coat of resin. For maximum comfort and efficiency, the bindings should be mounted so that the heel section just touches the toe section when the heel is fully advanced as seen in Fig. 6. Before driving the screws, drill a pilot hole at each location. In cases where the bindings require holes to be drilled through the ski, drill an oversized hole first. Place a sheet of wax paper under the ski and fill the hole with resin. When it is dry, redrill the hole with the proper sized drill. The screws will hold securely and the mountings will be completely sealed. ★ ★ ★



1. It's easy to put that vacuum cleaner on wheels. Attach four casters to a piece of plywood and secure the plywood to the bottom of the cleaner with self-tapping screws. In order to protect the furniture from nicks and scratches, staple a piece of heavy weather stripping all around the edges of the plywood

Solving HOME PROBLEMS

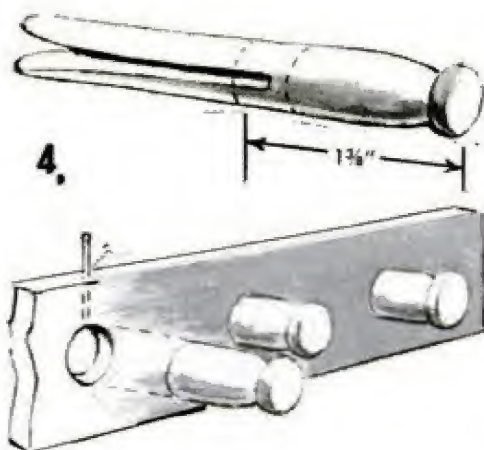


2. Weatherproof name tags for garden flowers and plants are made by wrapping small strips of cardboard in aluminum foil. Engraved deeply into the aluminum with a ball-point pen, the identifying names will also be pressed into the cardboard. In this manner, they will remain legible and unaffected by changes in the weather for some time



3. Large desk blotters used flat on bench or table surfaces won't get that dog-eared look if the corners of the blotter are first cut round. If you desire them cut to the size and shape of the working surface, fasten the corners to the table edges with tape. Blotters which are to receive extra-hard usage can be glued to a piece of heavy cardboard

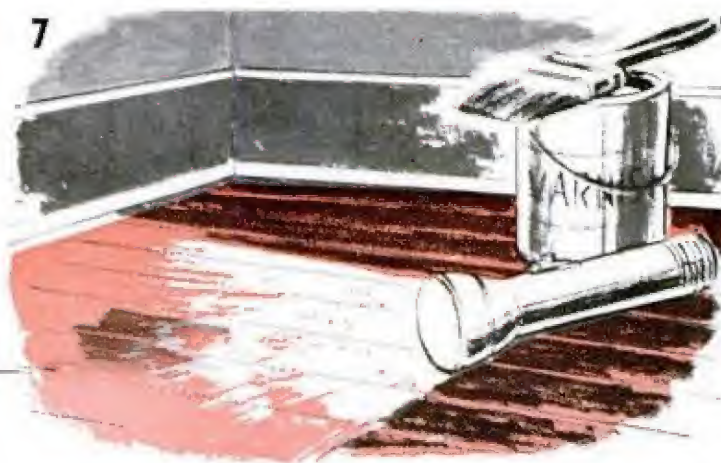
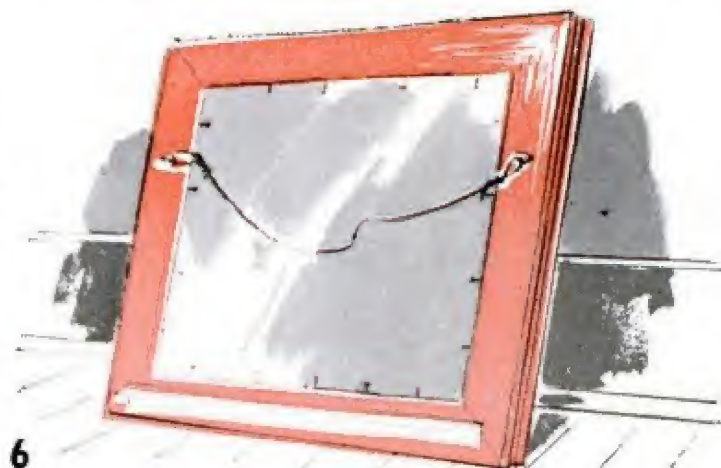
4. Rustic and attractive in appearance, a coat and hat rack is quickly made using the head ends of ordinary clothespins. Cut the pins to the desired length and snug fit them into holes drilled in a rectangular piece of wood. Secure the pins with a dab of glue, and sand and finish the rack with varnish or stain to suit your individual taste



5. Doors that are constantly kicked or flung open are stopped without a jolt by this chain and spring combination. A flexible chain runs through a door spring and both are fastened to the door and frame. As the door flies open the spring absorbs the shock and the chain completes the stop

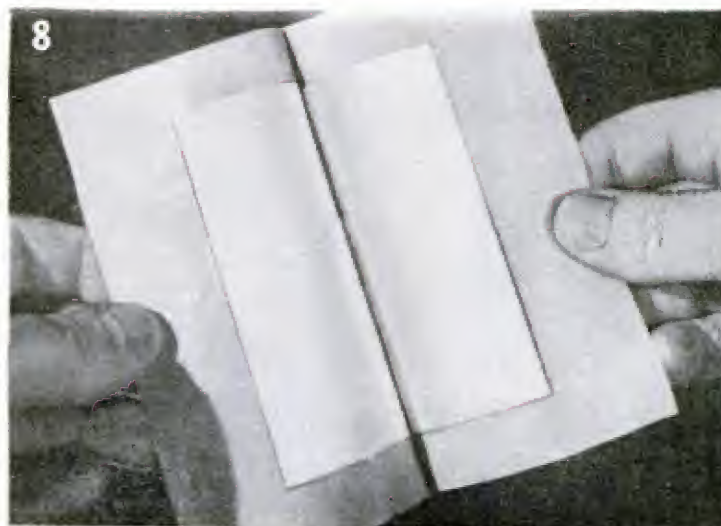


6. Small framed pictures won't tilt at an angle if a strip of cellophane tape is used to keep them in place. Fold a strip of tape lengthwise with the adhesive side out. Fasten one side of the folded tape to the bottom of the frame and press the frame to the wall so that the other side of the tape will hold it firmly in place



7. Next time you apply clear varnish to a floor, avoid the risk of missing a few spots by using a flashlight to show up the unvarnished areas. The finished portion will reflect the light, while the spots missed will reveal themselves by their dull and lusterless appearance

8. Wallpaper patches too thick to blend in with the rest of the wall can be reduced to half thickness by coating both sides with glue and placing them between two pieces of heavy wrapping paper. When the glue dries, pull the paper off. The patch will separate into two layers. Soaking in warm water will remove the paper





Shelf Mounted Between Studs

To set up a temporary shelf in a garage, cut a piece of wood so that it fits snugly between two of the garage studs. Drive two nails into each end of the wood and bend them upward at right angles. Insert the shelf and tap the nail heads into the studs.

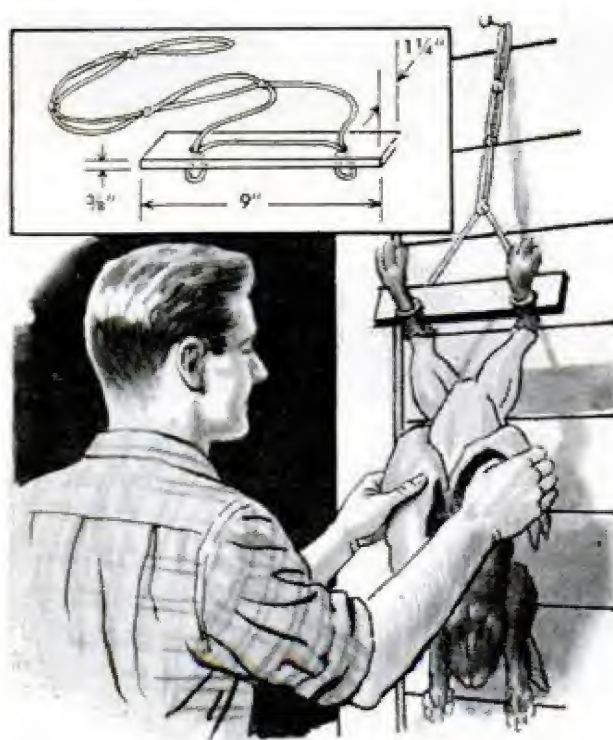


Auto Ash Tray Lined With Foil

Automobile ash trays lined with aluminum foil are easy to clean since the foil can be lifted out, emptied, and put back again. The foil also acts as a reflector so that the driver need not take his eyes off the road and grope in the dark for the ash tray.

Gambrel for Skinning Small Game

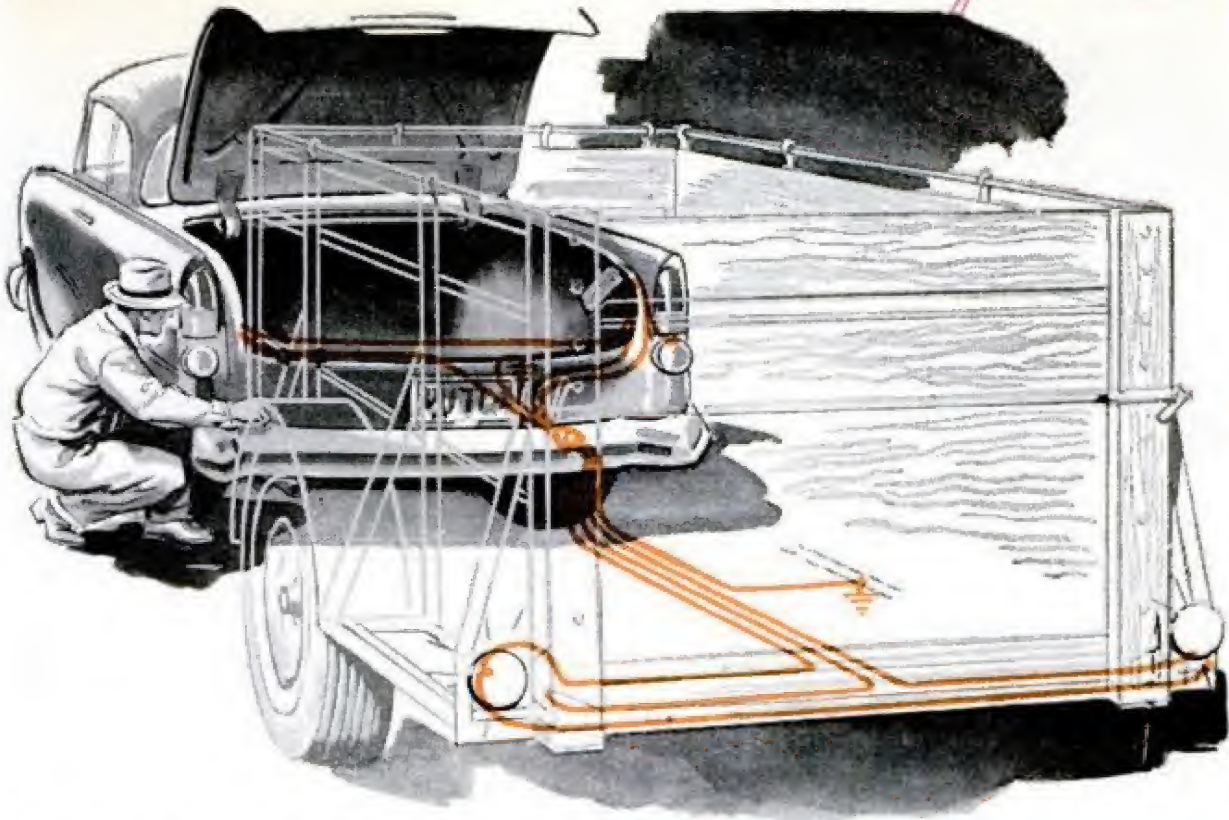
Rabbits and other small game are easy to skin if hung on this simple gambrel. Drill two holes in a piece of wood. Double a 4-ft. length of cord, tie the ends together and knot it at four 4-in. intervals. Insert 1½-in. loops through the holes to hold the animals legs while you do the skinning.



Raincoat Used as Storage Bag

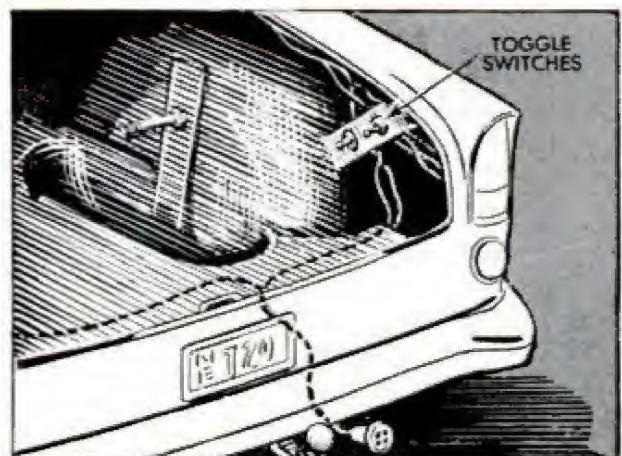
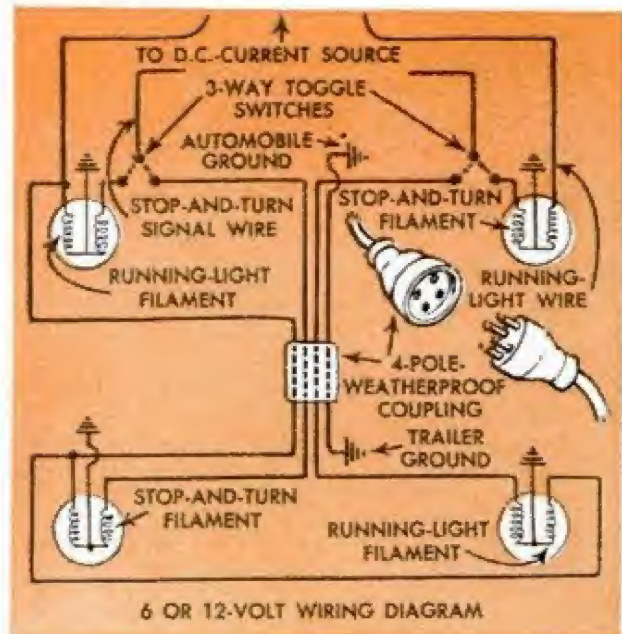
Button a plastic raincoat over heavy coats and clothes. It makes a good storage bag. Or use it to protect street clothes hung up in a dusty shop. The clothes in turn help keep the coat's shape by preventing the hanger from creasing and damaging the shoulders.





Turn-Signal Lights Switch to Trailer

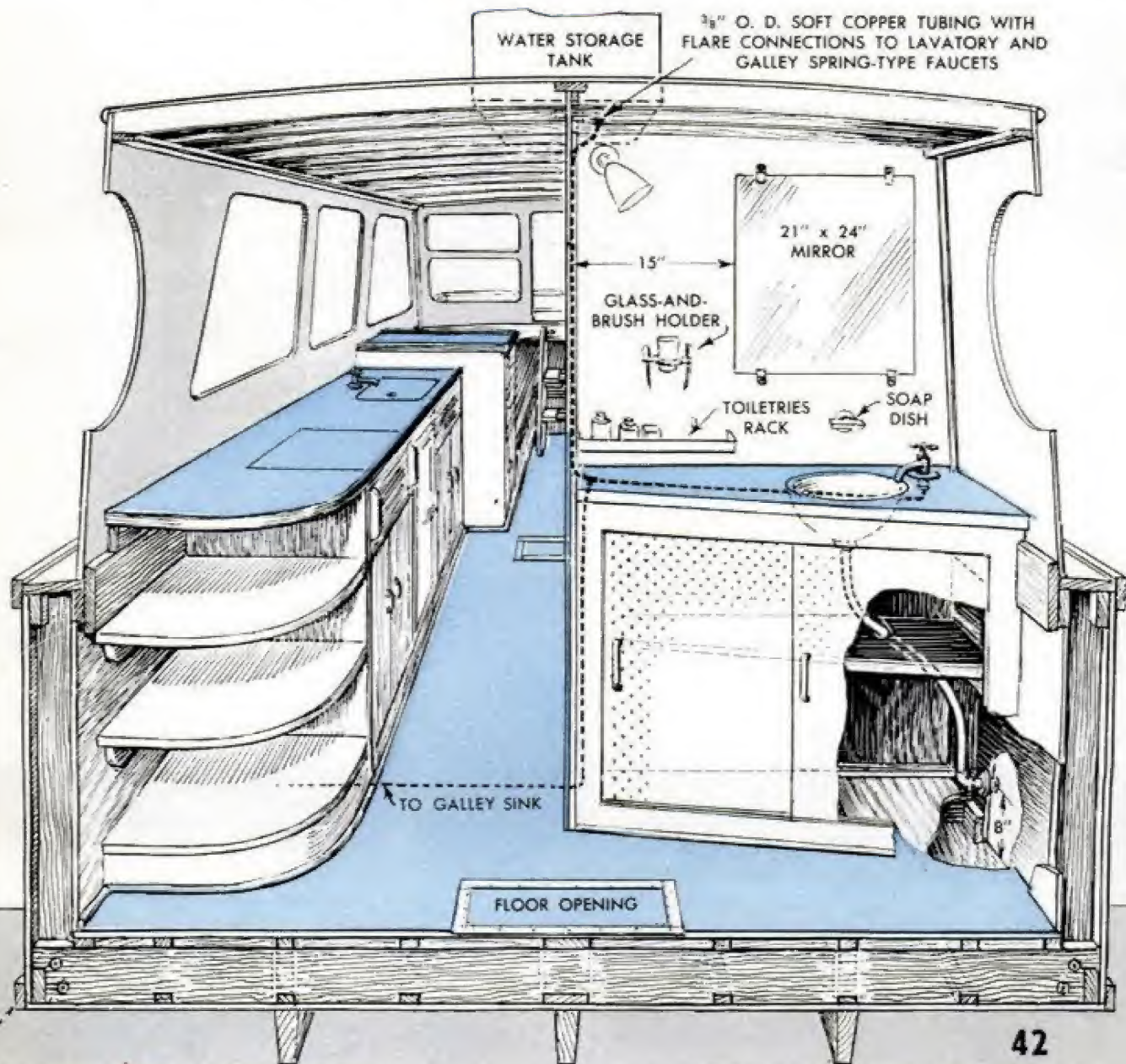
THIS SIGNAL-TRANSFER system is designed to eliminate the danger that arises when a trailer hides the rear lights of its towing vehicle from traffic. The system consists of two three-way toggle switches, two stop-and-turn taillight units, a four-pole weatherproof electrical coupling, and whatever length of 16-gauge, double-conducting wire is necessary to equip your car and trailer. Essentially the setup involves extending the car's rear-light circuit through the coupling to a similar circuit in the trailer. A connection is made from the car's running-light wires to the corresponding wires of the trailer taillight units. This allows running lights on both car and trailer, eliminating any blind spot. The car's stop-and-turn filament, however, is bypassed by means of the toggle switches and the current is relayed directly to the trailer units when the switches are thrown. This is necessary because the factory-installed flasher is unable to handle the front, dash, and rear signal lights of the car, plus the additional load of the trailer bulbs. Wired directly, without the switches, the trailer lights would flash at a very slow interval, defeating their own purpose, and eventually the added load would burn out the flasher unit. When the trailer is not in use, the switches can be thrown so that the current is restored again to the car's signal lights.—Richard C. Crawford, San Francisco, Calif.





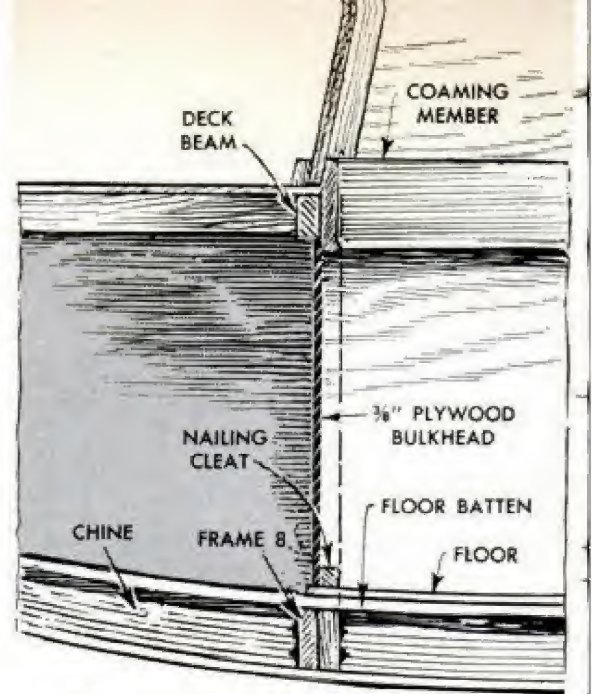
BUILDING THE **PM** HOUSEBOAT

Part IV

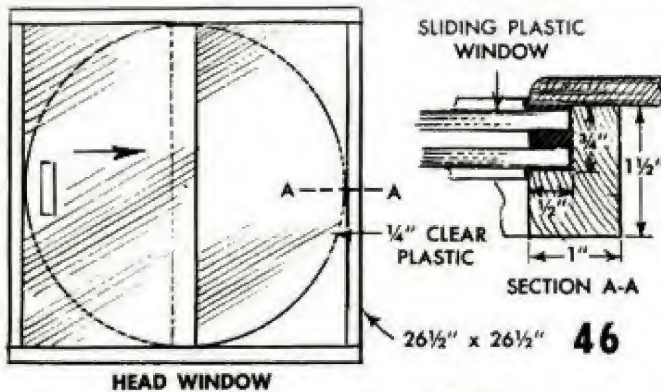


With the vanity installed, you can tackle the cabinet that houses the water closet. This is detailed in Figs. 44 and 45. It is designed to also serve as a seat, the top being fitted with double cushions which are stood on end to make the hinged cover accessible. Like the dining nook, the water-closet cabinet consists of an inner framework of 1 x 2s covered with $\frac{1}{4}$ -in. plywood. Before this cabinet can be built in place, a watertight bulkhead must be fitted across the cabin at frame 8. As you will see in studying Fig. 48, this is a $\frac{3}{8}$ -in. panel which is fas-

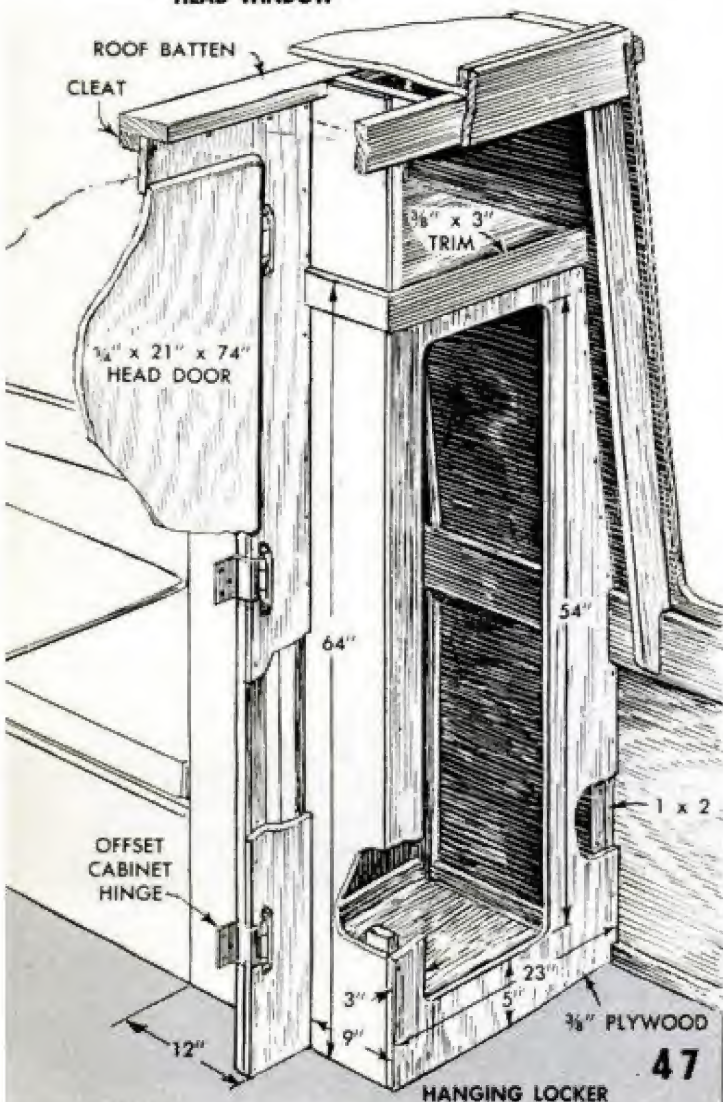




48 HOW BULKHEAD SEALS OFF AFT HATCH



HEAD WINDOW

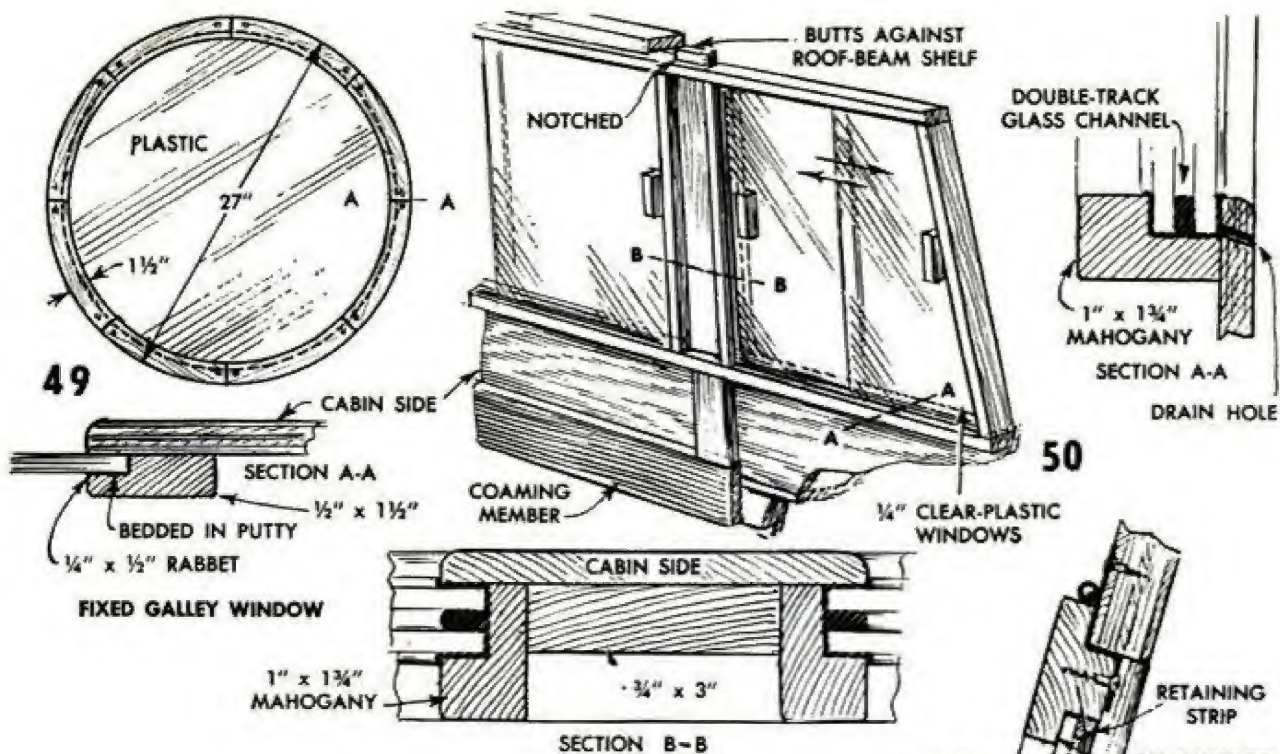


HANGING LOCKER

tened to the aft faces of the frame side members, to the aft face of the coaming member and to a cleat screwed and glued to the floor and into the top edge of the bottom frame member.

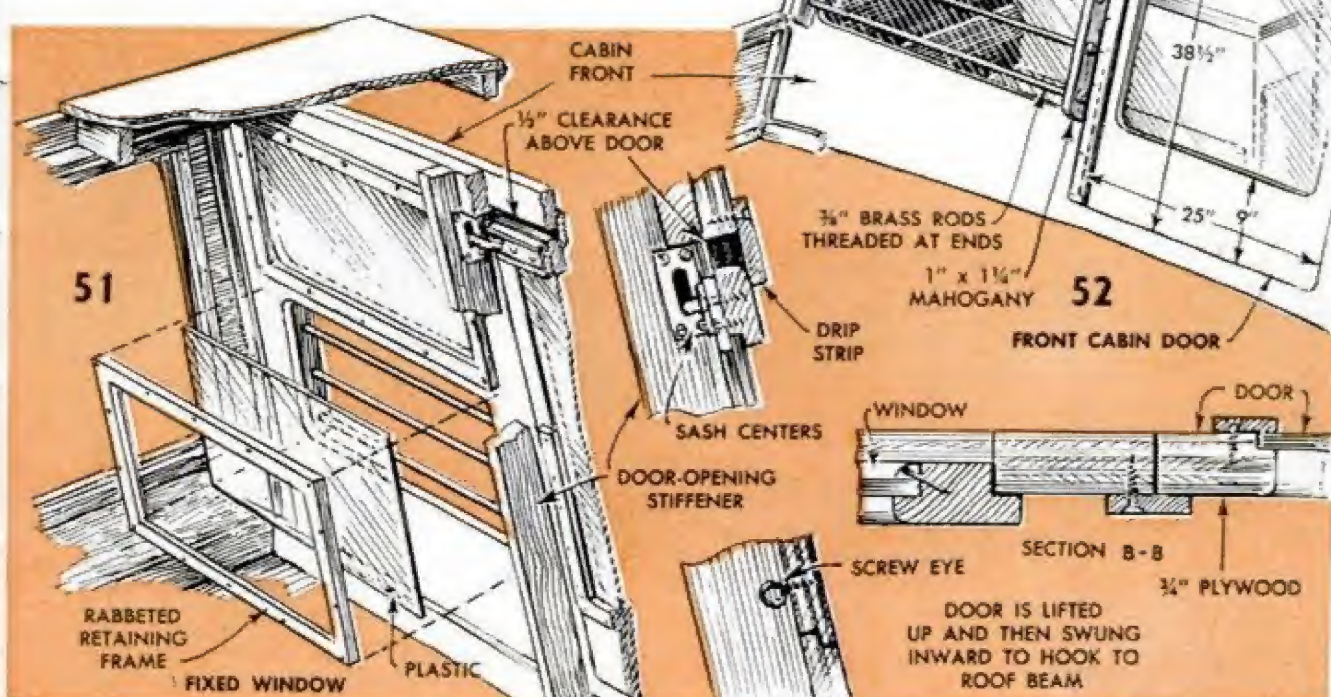
Set this panel in bedding compound and fasten it in place from the hatch side. Overall length of the water-closet cabinet is 32 in. and is located 6 in. aft of frame 7. Overall width of the hinged cover is 21 in. and the cross members in the top of the cabinet are spaced accordingly to support the overhanging lip. As shown in Fig. 44, the cross members are located 7 in. and 4 in. respectively from the ends. The 13½-in. height of the cabinet will accommodate a standard marine water closet. The through-the-wall fitting for the drain hose is located at a point just below the water line. To make the hose connection, it will be necessary to remove a section of the side wall inside the cabinet. There's space within the cabinet for a chlorinator which is a requirement if you navigate restricted waters.

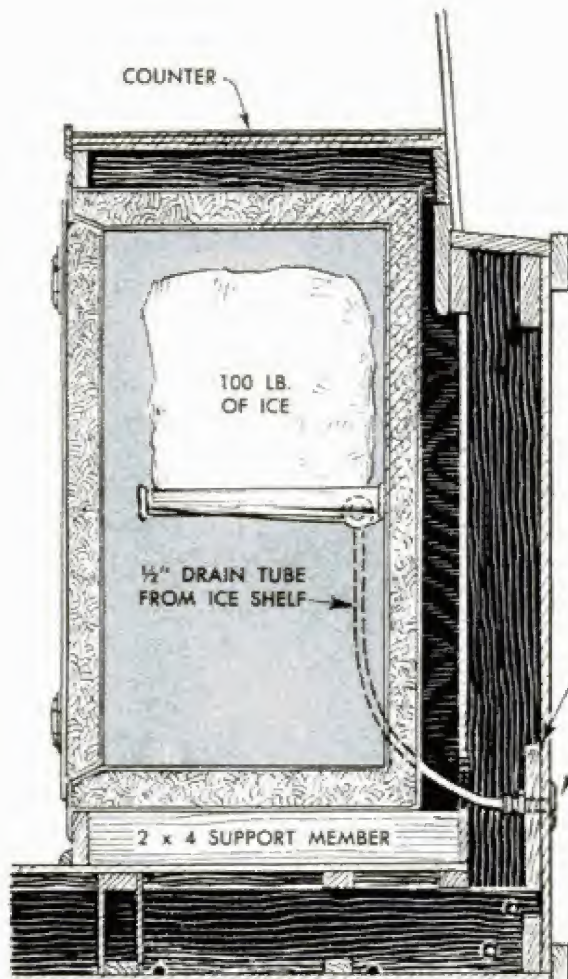
The hanging locker is detailed in Fig. 47. This also is made of ¼-in. plywood, and like the others, is backed up at the corners and edges with 1 x 2 members to which the plywood is nailed. It measures 21 x 23 in. and extends from floor to ceiling. An alcove is formed in the upper part and faced with a ¾ x 3-in. projecting trim piece to keep the contents in place. The locker is left without a door and a horizontal clothes rod is installed inside for coat hangers. The back of the locker, incidentally, serves to support the end cleat of the water-closet cabinet. Details concerning the door and door opening of the enclosed head are found in Figs. 43, 45 and 47. Cleats, as before, are used to support the ¼-in. plywood wall, these being fastened to the underside of the roof batten, as well



as to the hanging locker, the vanity and the floor. The door is $\frac{3}{4}$ in. thick and has a lip all around to lap the opening. Three offset cabinet hinges are used to hang it, after which a rim-type latch is added to lock it.

Completion of the head and the hanging locker completes the cabinets on the starboard side. Since the galley will interfere with the framing of the windows if done later, the latter should be installed next. The two circular windows differ in that the one on the port side is fixed, whereas the one in the enclosed head is made movable. You have a choice of using either glass or

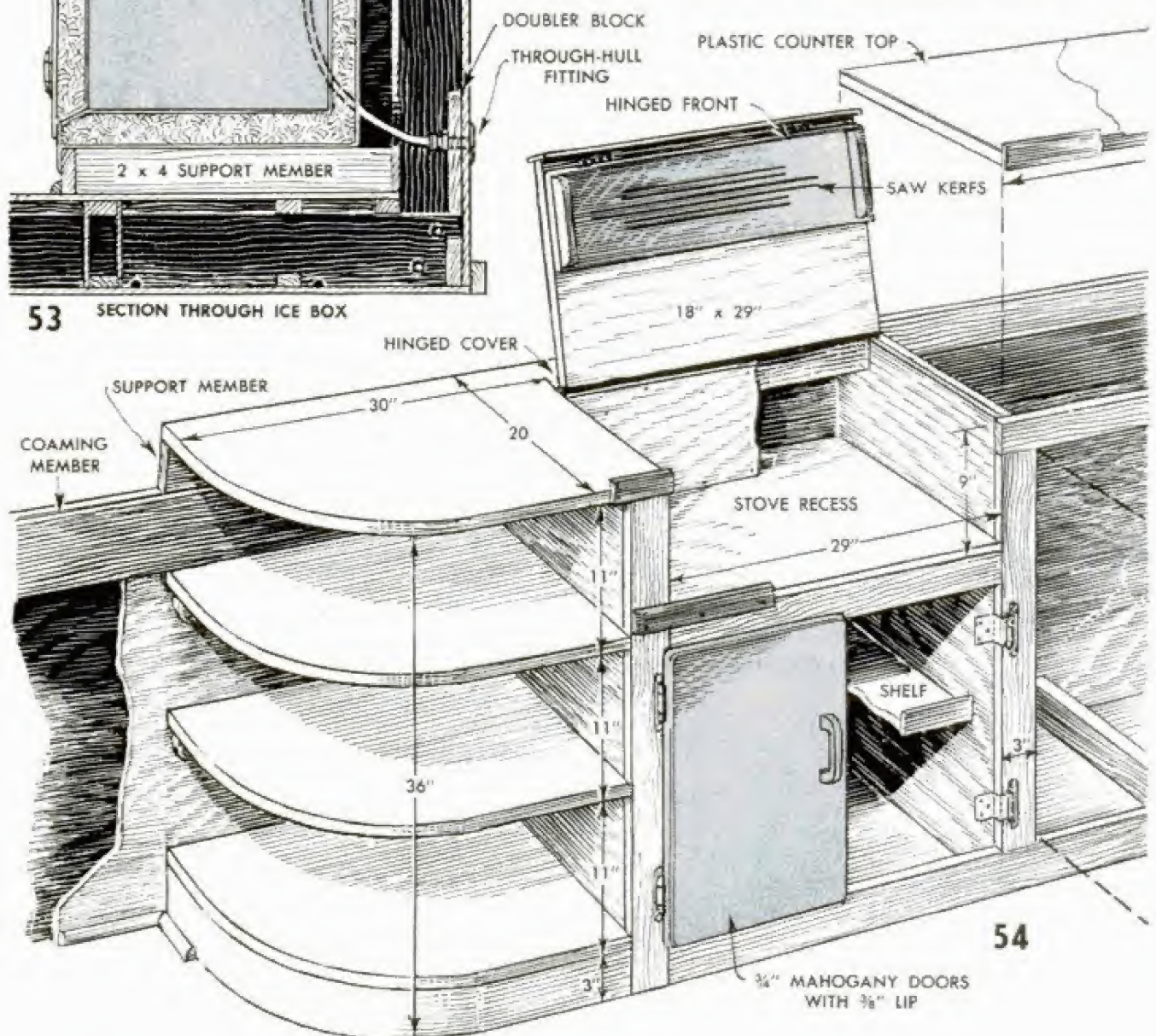




53 SECTION THROUGH ICE BOX

clear plastic for the windows. Plastic has one big advantage over glass in that it can be sawed to fit the openings. For this reason, plastic was used in the PM houseboat. Fig. 49 details the fixed, circular galley window. This is a 25-in. disk of plastic which is centered over the opening, on the inside, and held with a mahogany frame. The plastic is bedded in putty to make it watertight, and the circular frame is in six sections, each rabbeted to fit over the edge of the plastic as in section A-A. Short screws are used to hold it in place. In the case of the sliding head window, the plastic is cut to fit standard double-track metal channels. Fig. 46 shows how the channels are held in rabbeted members assembled in a square frame and then centered over the circular opening in the cabin wall.

The same double-track channel is used in

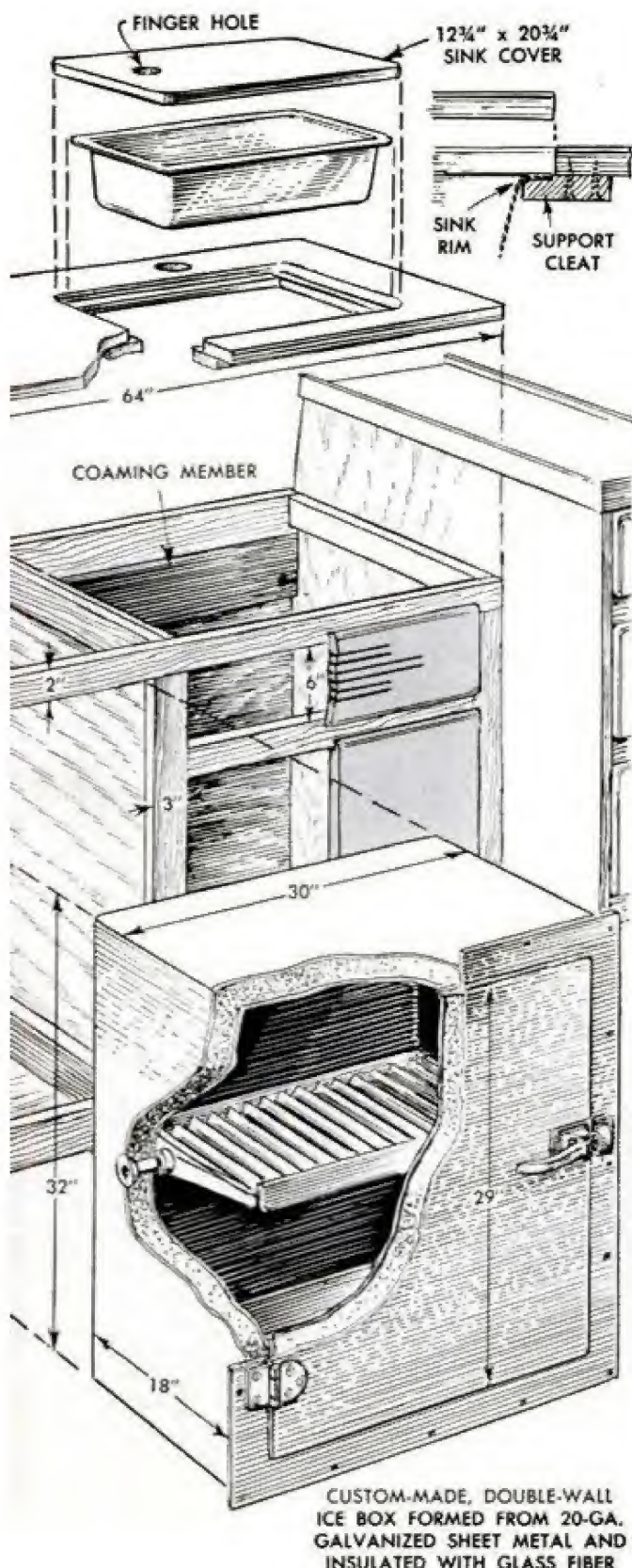


54

FLOOR COVERED WITH LINOLEUM
OR VINYL TILE

HOUSEBOAT BLUEPRINTS

If you prefer to work from plans larger than magazine-size, blueprints can be purchased at \$10.00 per set of eight sheets by writing to Popular Mechanics, Blueprint Dept., 200 East Ontario St., Chicago 11, Ill.



Two-piece hinged cover conceals stove housed in recess in galley counter. Front of cover is mahogany

all the other sliding windows. Sections A-A and B-B, Fig. 50, show how it, too, is held in rabbeted mahogany members and assembled in a single unit to suit the window openings. In studying section B-B, you will see that $\frac{3}{4}$ x 3-in. vertical posts are first added to stiffen the plywood at points between the window openings. These members rest on the coaming members and butt against the underside of the roof-beam shelves. The frame assembly is notched to fit over the posts, after which it can be fastened in place with glue and screws driven in from the outside. Both starboard and port window-frame units are made alike. Handles of plastic or metal are attached to the plastic and a felt strip is cemented to one bypassing pane to fill the gap between. All the windows in the front wall of the cabin are fixed except the windshield. This is hinged to swing outward and thus give the helmsman a better view forward from a standing position when docking. The frame for the windshield is a double-rabbeted affair (see section A-A) which is designed to lap the opening like a lip door. A standard adjustable windshield bracket holds it open. The three other front windows are installed in the same manner as the circular galley window, the plastic being held with rabbeted retaining frames as shown in Fig. 51. Sectional details accompanying Fig. 52 show how the forward door is hinged at the top with special hardware called sash centers. Slotted plates, plus a $\frac{1}{2}$ -in. clearance above the top of the door, permit the latter to be lifted up to clear the bottom rabbet before swinging it inward and overhead. A hook attached to a roof beam engages a screw eye in the

(Continued on page 246)



Light Warns Drill Operator When Bit Contacts Buried Pipe

When drilling through a concrete floor, one excavating contractor uses the warning device shown above to avoid damaging buried electrical conduit or pipe, the layout of which is unknown. When the bit makes contact with the pipe, the circuit containing the flashlight battery and bulb is completed, lighting the bulb as indicated.

H. Muller, Danboro, Pa.



Edges on Transparent Plastic Polished on Leather "Stone"

Cut edges on small pieces of transparent plastic can be polished to a clear finish on a "grinding stone" consisting of a piece of shoe leather cemented to a wooden block as shown above. Jeweler's rouge is used as an abrasive, which is worked into the leather with a putty knife before use and as often as necessary during a job.

Walter E. Burton, Akron, Ohio

Merry-Go-Round Improvised From Wagon Wheel and Axle

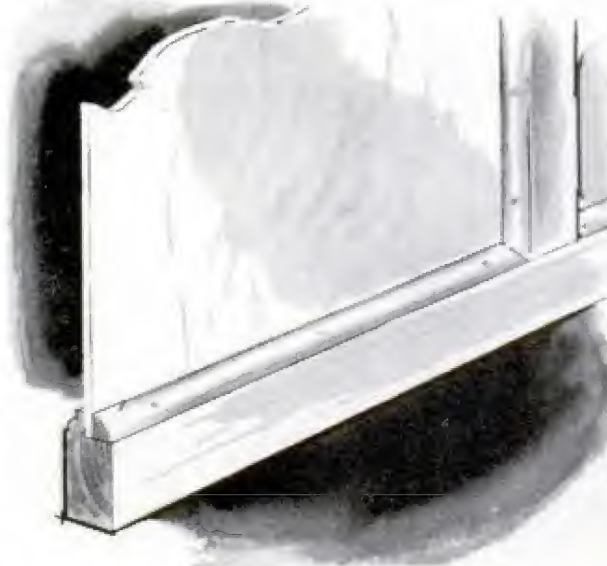
Children on one Midwest farm get hours of fun out of this improvised merry-go-round, which is a wooden-spoked wheel from an old high wagon. Painted in bright colors, the wheel is mounted on the original axle after the latter is placed in a hole dug to a depth to give the desired height from wheel to ground.

C. F. Marley, Nokomis, Ill.



Broken Panel in Garage Door Replaced the Easy Way

Here is an easy way of repairing a damaged panel in an overhead garage door. First trim off the edges around the panel on the inside of the door flush with the bottom of the grooves in which it is set. Then remove the damaged panel, cut a new one from $\frac{1}{8}$ -in. plywood, and set it in a bedding of calking compound. Fasten the panel in place with quarter round.

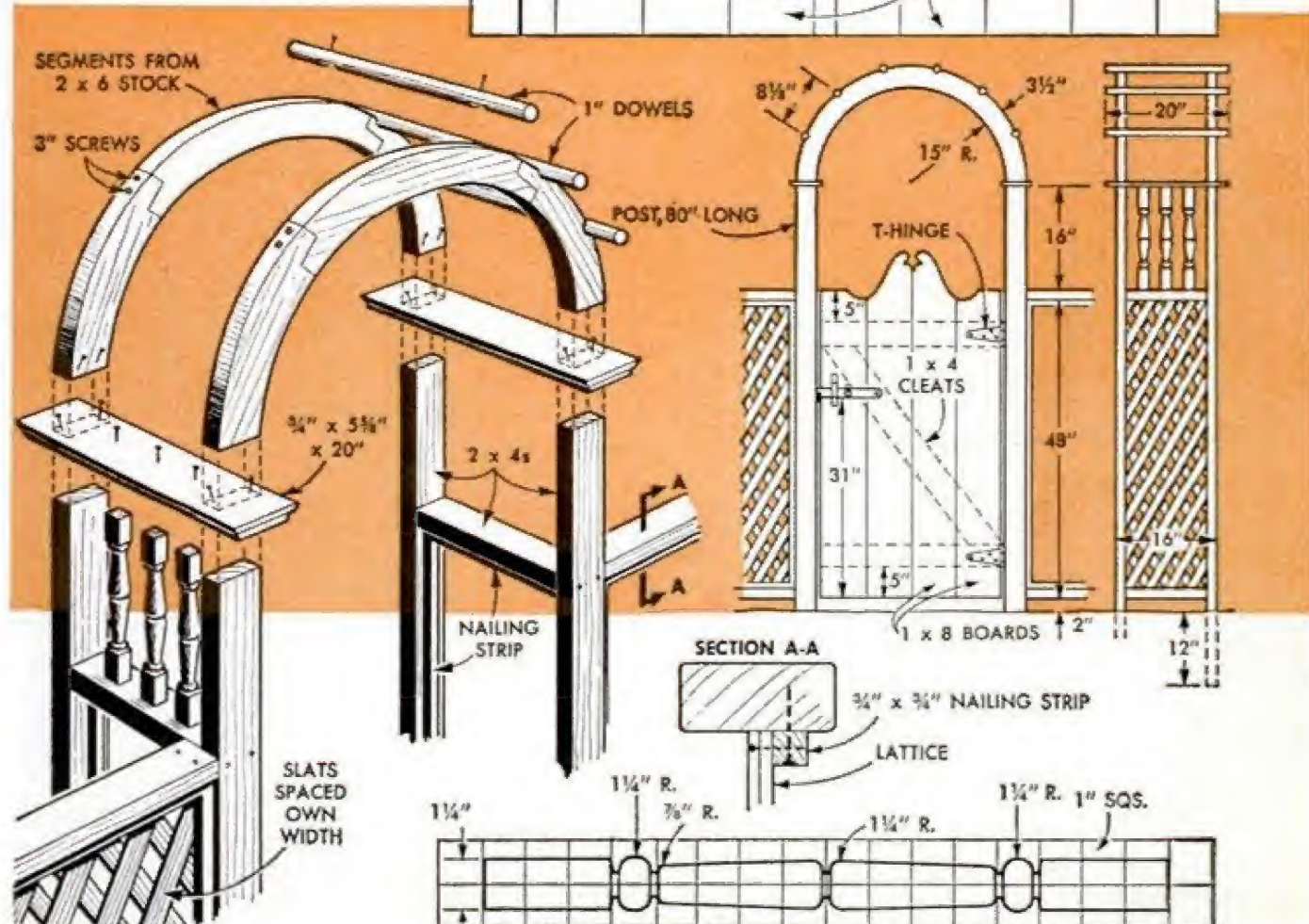
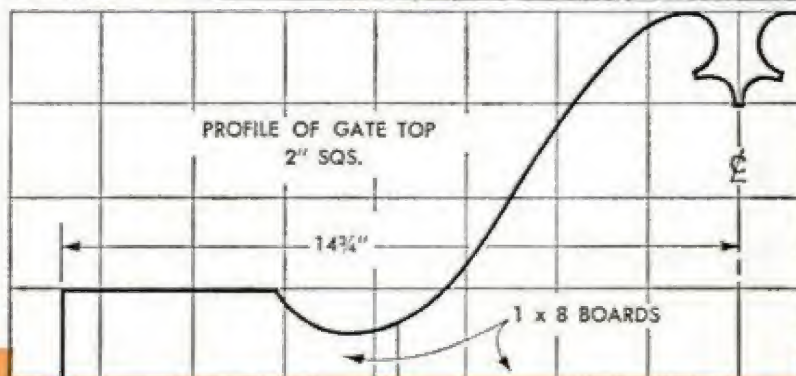
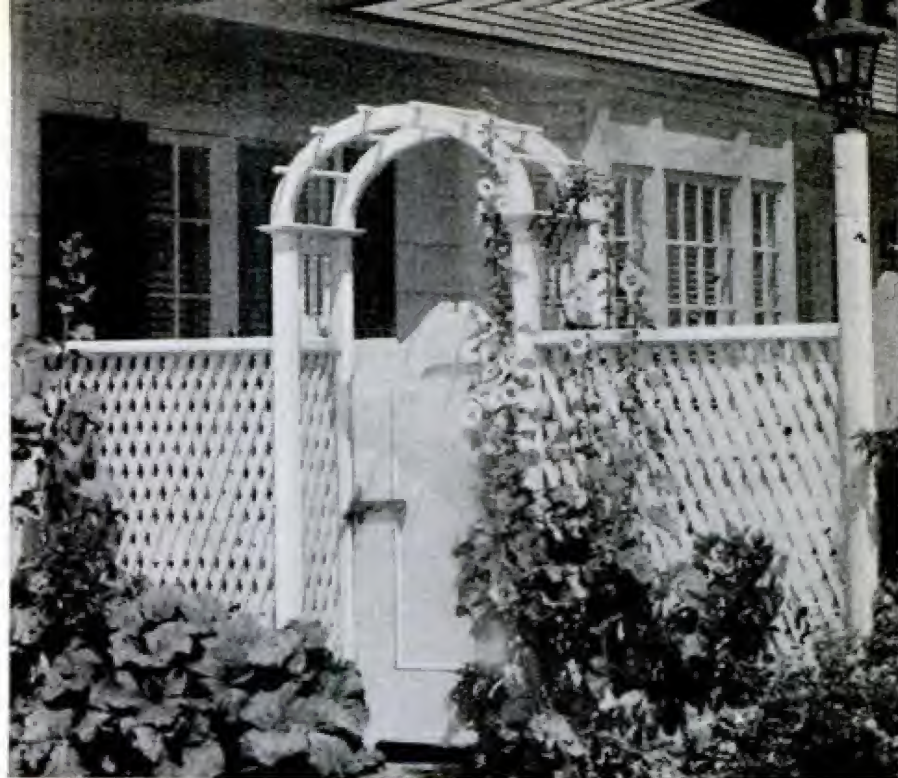


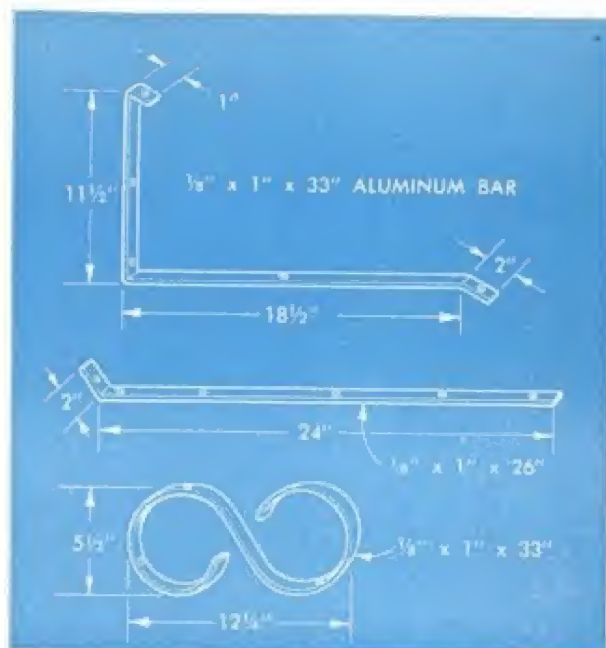
GARDEN GATE GIVES PRIVACY

By Hi Sibley

"CHARMING" is the word that best describes this white-painted garden gate and lattice fence which separate the lawn from garden area of a Western home. Parts for the gate, gateway and fence are cut and assembled as shown in the drawing and details. Dowels may be substituted for spindles on the gateway, if a lathe to turn them is not available. Full-size patterns of arch segments and gate top should be made to ease the job of cutting them.

Horizontal members between post and arch ends consist of a beveled top piece glued and nailed to a straight-edged bottom piece as shown. Both are cut from 1-in. stock. A thumb latch and hinges are installed so that the gate swings inward.





Since there will be other things to do outside when another month rolls around, you'll be wise to

START NOW TO MAKE YOUR OWN GLASS-FIBER

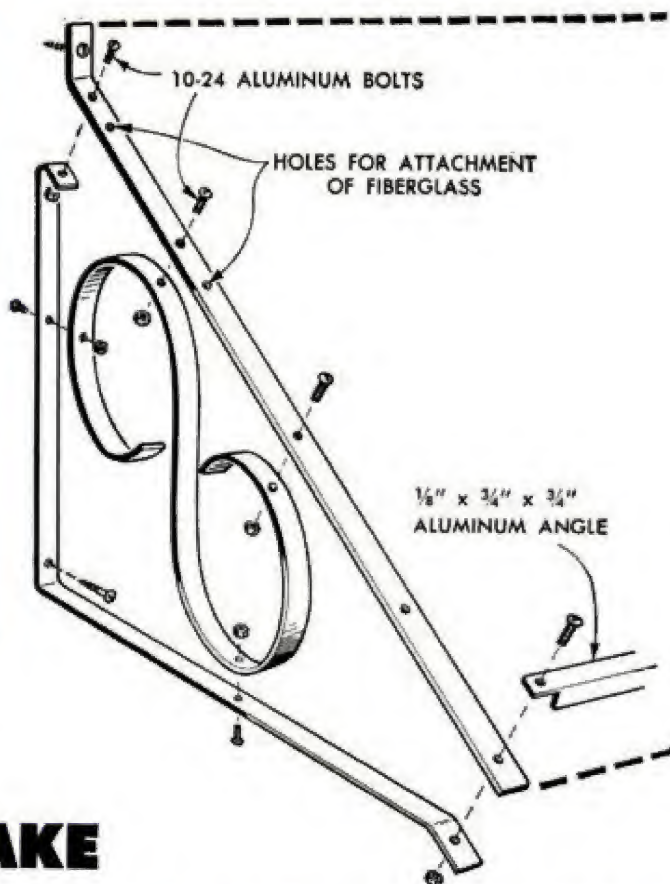
By James A. Lockhart

AN EVENING or two and only a few common tools are all it takes to convert a panel of colorful glass fiber into a handsome and durable window awning. What's more, you can hang it and forget it. It requires no painting and will withstand the weather indefinitely. Being translucent, the glass fiber keeps the hot sun out yet lets the light in, and, of course, the material is extremely lightweight.

The decorative end brackets are made of flat, bar-stock aluminum which you will

find in hardware stores and in some lumber yards, usually in 6-ft. lengths. Each bracket consists of three parts and each pair of brackets is joined across the front with a length of 3/4-in. aluminum angle. The length of the latter will vary from window to window but the size of the bracket will suit practically any window of average size.

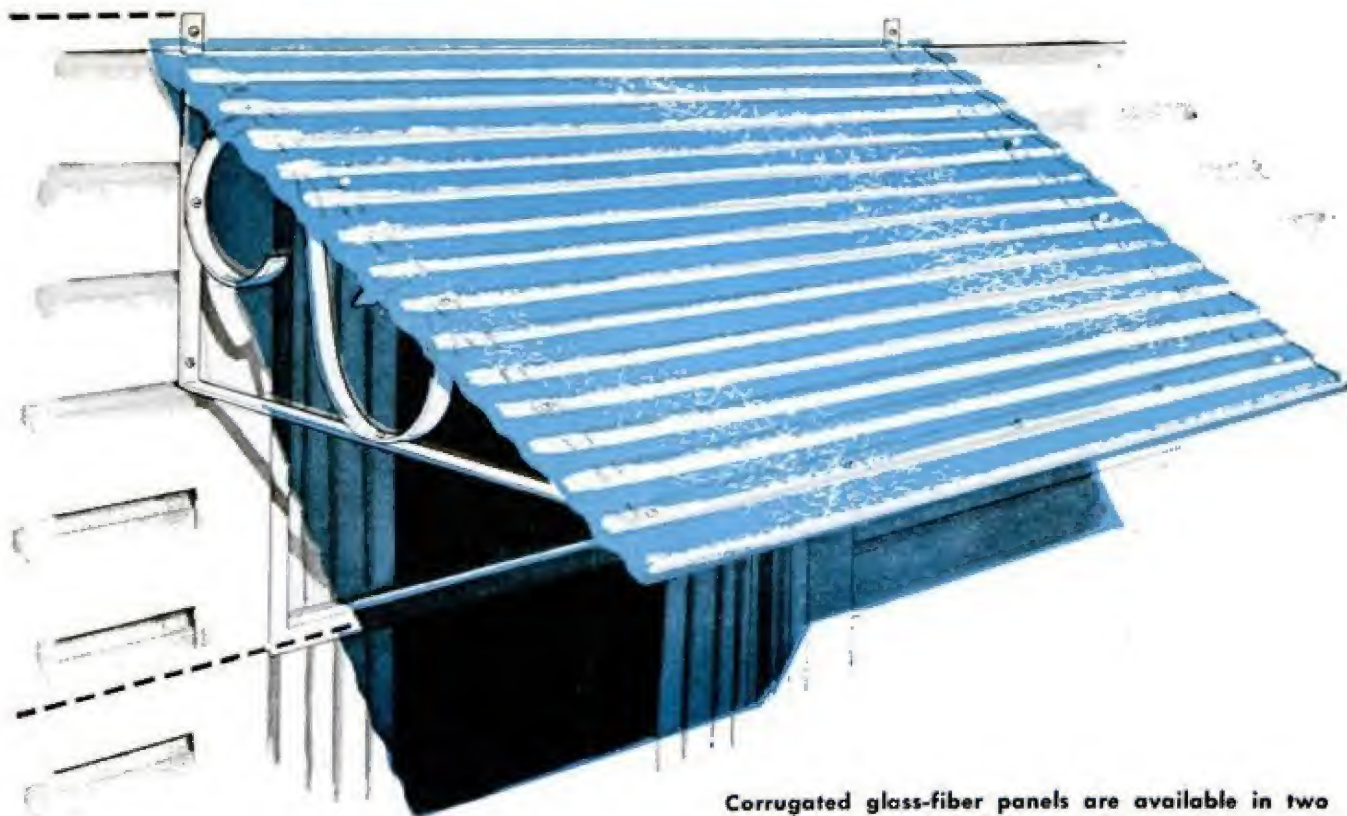
Forming the parts is easy, the straight bends are made in a vise, whereas the scrolls are duplicated by using a 1-lb. coffee can as a bending form. Both the can and



WORKING WITH TRANSLUCENT PLASTIC

Although glass-fiber panels contain some 25 percent glass, the material can be cut easily with an ordinary handsaw. However, when an electric power saw is used, it is recommended that the saw be equipped with an abrasive cutoff wheel or with a metal-cutting blade having teeth but no set. Whereas corrugated panels must be sawed, flat-type panels can be cut with ordinary tin shears. A grease pencil is ideal for marking the plastic for cutting. In many cases, the project can be planned so that no cutting is required at all. An awning, for example, can be designed to make use of a full standard-length panel.

While a nail can be driven through the material, it is best to drill a pilot hole. When screws are used to fasten the panels, the holes should be made slightly smaller than the screws to prevent surface cracking when the screws are driven home. In all cases, it is recommended to back up the hole with a wooden block. Also, regardless of the type of fastener used, it should be rustproof, such as aluminum, galvanized or cadmium plated, to avoid the formation of rust stains on the plastic. Where important, the fastener also should have a soft-rubber washer around its head to assure a watertight seal.



Corrugated glass-fiber panels are available in two weights, standard and heavy, the standard weight being ideal for awnings. Panels measure 26 x 96 in. and have 2½-in. corrugations. They are resistant to humidity, salt-water air and temperature changes

AWNINGS

the aluminum are clamped together between the jaws of a machinist's vise, the can being held by its rim. Being fairly soft, the aluminum is easily wrapped around the rim of the can as shown in the photo below. The trick is to keep moving the aluminum strip in the vise as the bending progresses. Wrapped in one direction, the work is then turned over to form the second loop. The completed scroll should measure about 12 in. long. The lengths of the two other parts of the bracket are given in the drawing at the left. In assembling the brackets, be sure to use aluminum bolts to avoid an electrolytic action resulting when steel and aluminum are combined. Since holes must be drilled in the brackets for mounting them, as well as for attaching the glass-fiber panel, it will be advantageous to drill them beforehand. Although aluminum will stay bright and shiny for a while, it will corrode and become dull in time. In view of this, it would be best to paint the brackets and to do so before attaching the glass-fiber covering.

The length of the latter is dependent upon the width of the window. An awning for the average single window should measure about 60 in. which will allow for a 5-in. overhang at the sides and front. The ¾-in. aluminum angle supporting the glass fiber

along the front edge of the awning is notched at the ends for attaching to the brackets. Here, as you will notice, a single bolt holds all three members together. If corrugated glass fiber is used, the holes for the bolts should be made in the areas between the ridges at least along the ends where the panel is bolted to the brackets. The brackets can be screwed to the house, using, as before, aluminum screws instead of steel. ★ ★ ★

Scroll part of bracket being bent around coffee-can form. Both can and work are clamped in vise





Made entirely of wood, TV snack-tray set is useful and attractive addition to living-room furnishings

Feet on bottom of tray hold tray in place on TV table and provide finger clearance when on flat surfaces

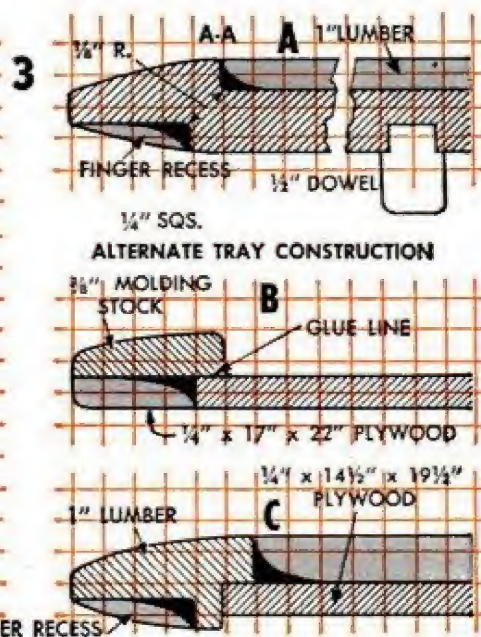
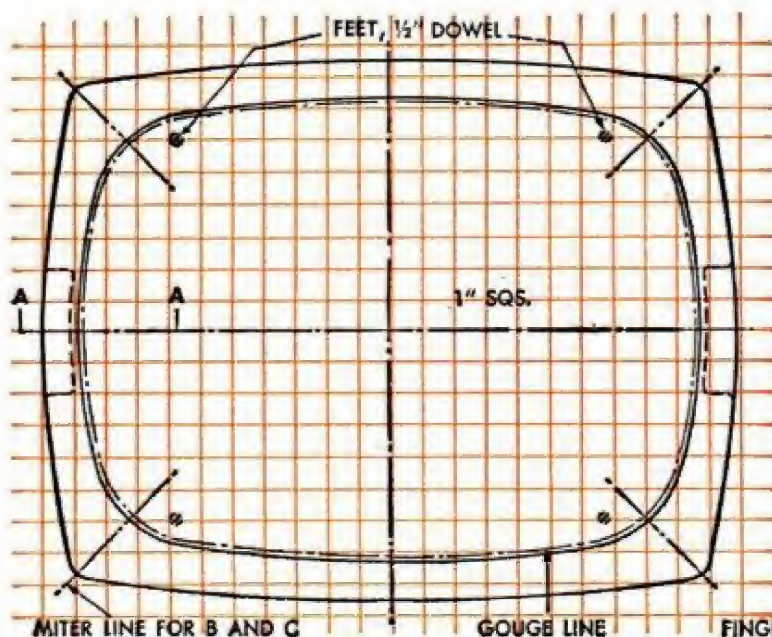


TV SNACK-TRAY SET

By John Jefchak



HERE is a TV snack-tray set that will please the most discerning of modern hostesses. It was designed and built by PM editors expressly for readers who prefer the "solid feel" and durable beauty of all-wood furniture. Trays are a big 17 x 22-in. lunch size, each of which has four short feet that bear against the top rails of the table, holding it in place, Figs. 1, 2 and 3. These feet also provide finger clearance, making it easy to pick up trays from a flat surface. Peg stops on the inside legs of the table, Figs. 5 and 6, bear against the outward edge of the outside legs when the table is set up to receive the tray, eliminating the need for



OF DURABLE BEAUTY

friction catches to hold it in place as is the case with most metal sets. This important feature permits a loaded tray to be removed from a table without having to grasp the latter with one hand while separating them.

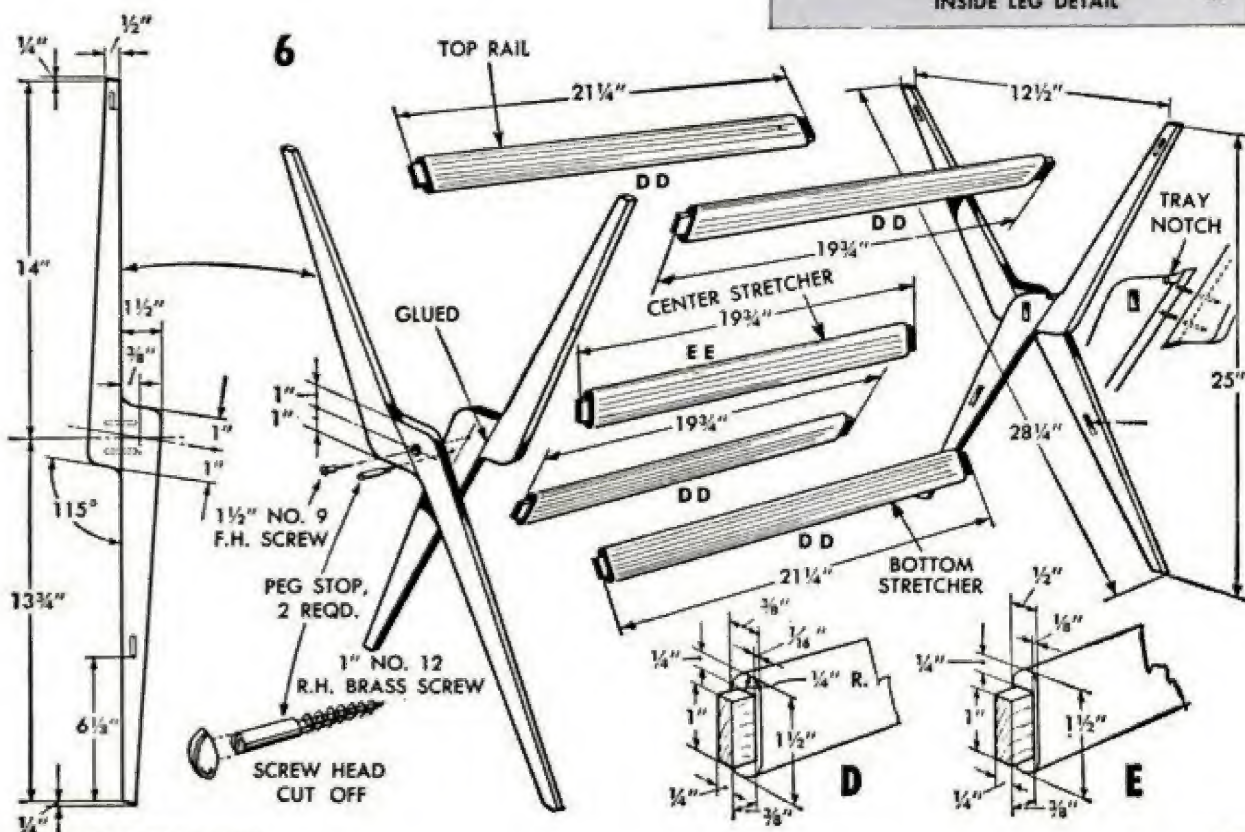
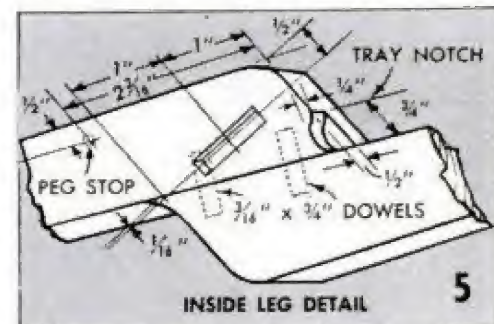
Construction details of this snack-tray set have been kept simple so that almost anyone should be able to build it with little difficulty, even those whose only experience with tools is limited to the use of a borrowed hammer or saw. Power tools are not an absolute necessity. They simply make the work easier and faster. The type of wood used for the project depends upon individual preference. Softwoods (pine, redwood, cypress, etc.) are economical and easy to work but they lack the strength and beauty of hardwoods, such as walnut, mahogany and oak. At this point you should decide on the type of finish to be applied to the completed set, since it may affect the selection of wood. While paint will cover walnut and pine equally as well, you can't expect to make pine look like beautifully-grained walnut simply by applying a finish of stain and varnish.

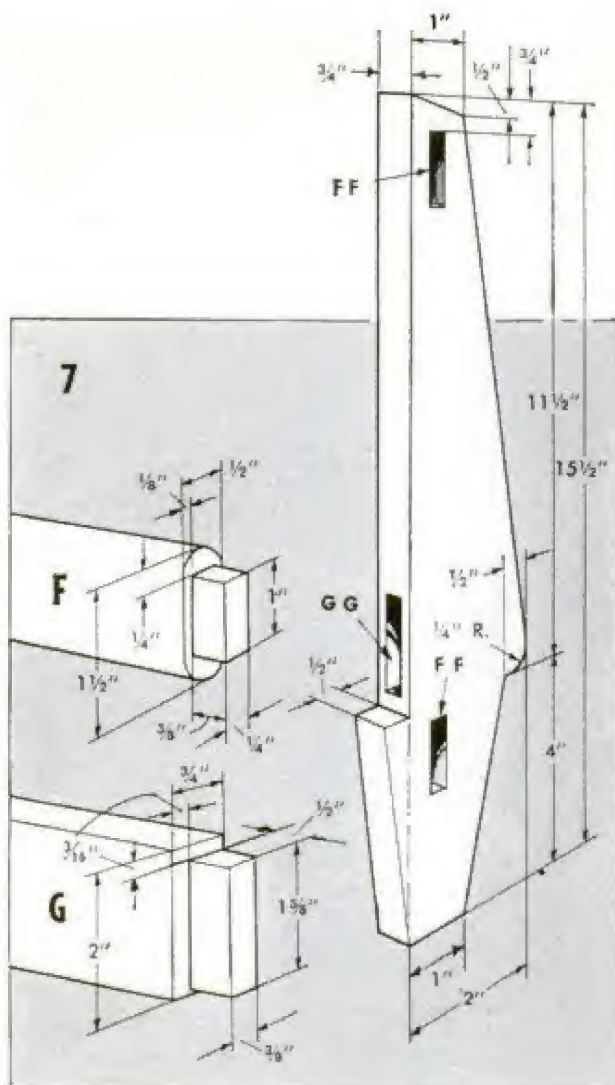
Begin the project with construction of the trays, then make the folding tables, followed by the storage rack. With this sequence, if an error in construction is made, it can be noted easily and corrected without much difficulty or without affecting the finished product. Plastic-resin glue is the only fastening used for all joints, except the two-piece legs which are fastened with glue and dowels.

The tray was formed from two pieces of 1 x 10 x



When table is folded, tray nests between upper halves of legs for compact storage

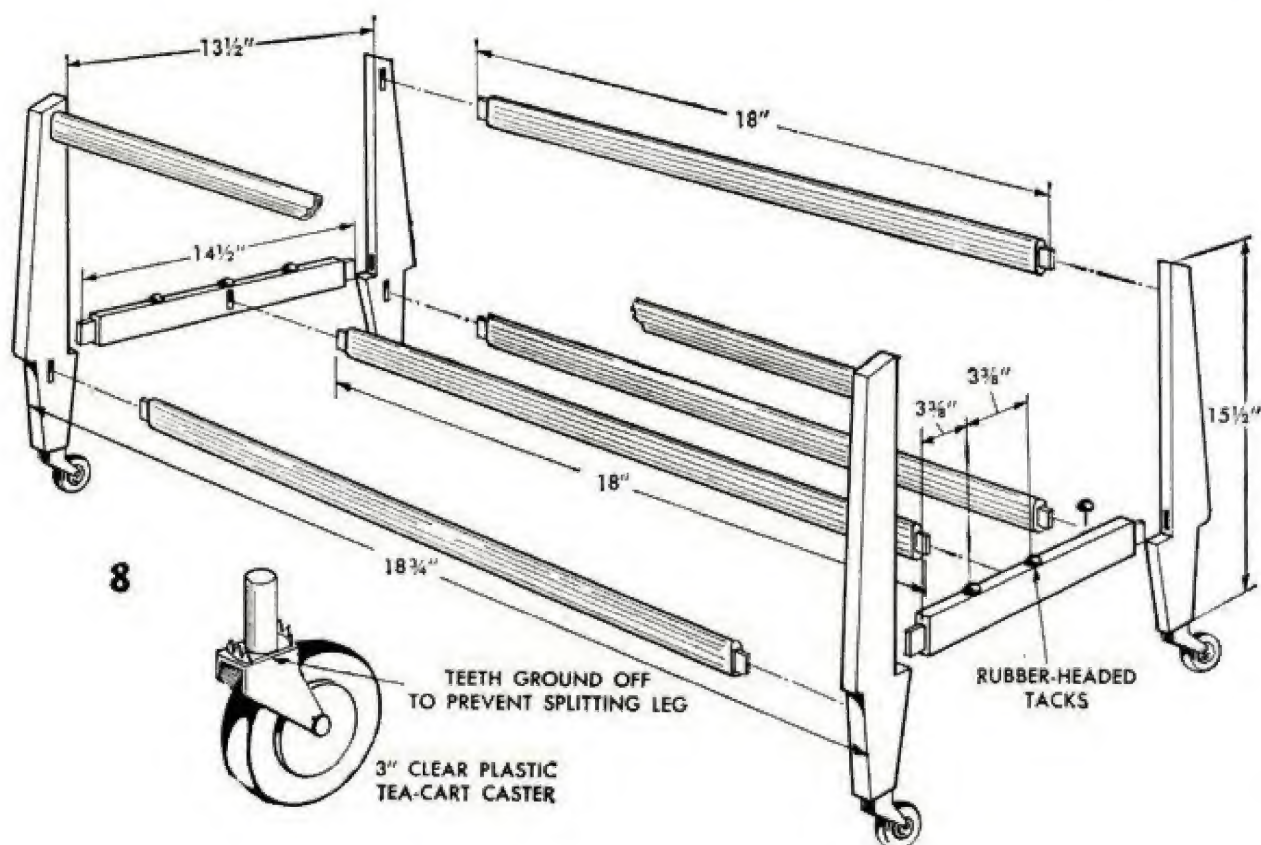




24-in. lumber edge-glued together. Finger recesses and the recess in the tray top were routed out with a router bit chucked in a drill press. This also may be done with a portable router, or by hand with a gouge. In either case, waste is removed only to the gouge line indicated in Fig. 3. Then the inside edges are rounded to a $\frac{1}{8}$ -in. radius and, at the same time, the upper edge of the recess is worked to the finished dimensions as shown.

Details B and C show easy ways of making a tray when router tools are not available. In each case, plywood is used for the tray bottom. The tray recess is formed by a raised border consisting of mitered end and side pieces of solid stock glued to the bottom as indicated. Note the location of miter lines for this purpose in the top view of the tray. Rubber-headed tacks are substituted for the feet in this case.

Next the leg assemblies are made. Each leg is glued up from two pieces of $\frac{3}{4} \times 1\frac{1}{4} \times 16$ -in. stock, with two dowels fitted in each joint as shown in Figs. 5 and 6. The dowels strengthen the leg at the axis and save on material. Single-piece construction is permissible if hardwood is used. Note that facing edges of leg halves form a straight line, making it necessary to taper only one edge lengthwise. Locations for the tray notch (in which the tray edge rests when stored as in Fig. 4), peg stop, mortise for center-stretcher tenon and placement of reinforcement dowels of leg joints

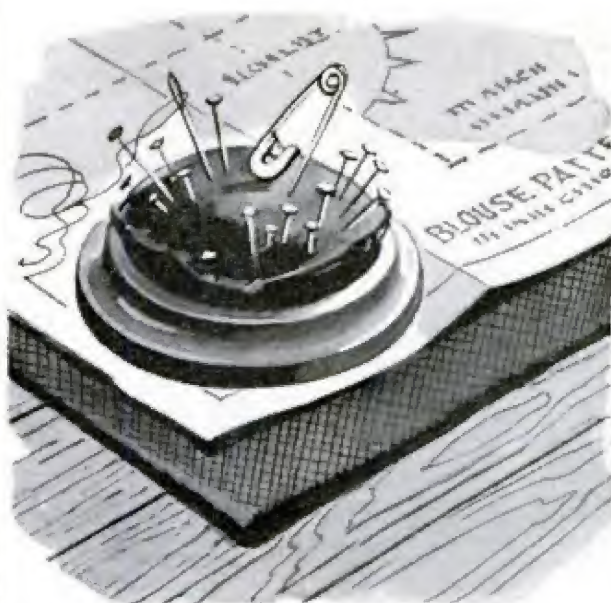


are given in Fig. 5. Dimensions for tenons are given in details D and E. To assure a perfect fit of trays on tables so they can be used interchangeably, assemble one unit before starting the others, omitting the glue until later. The first unit can then be disassembled and the legs used as patterns when locating the pivots and peg stops on the legs of the other units.

Locations of the top rails depend upon the style of tray used. For tray styles A and B, the distance from the tops of inside legs to the upper edge of the attached rail is $\frac{1}{2}$ in.; $\frac{1}{8}$ in. for the outside ones. For tray style C, uppermost edges of both rails should be flush with the tops of the legs. When cutting mortises, use a drill press to remove most of the waste. Then finish with a $\frac{1}{4}$ -in. chisel. All edges on the table are dressed down to a soft radius.

The function of the storage rack is to provide a handsome display-type storage facility for the tables and make it easy to carry them to and from the place of use. Its construction is simple and the lines are of the same contemporary styling as the tables, the offset characteristic of the leg profile being reproduced in both pieces. Begin by cutting out the legs, the detailed dimensions of which are given in Fig. 7. Mortise dimensions are taken off the tenons, details F and G. Note that the overall length of the rack, Fig. 8, is $\frac{1}{4}$ in. less than the distance between inside legs of the tables. This is necessary to provide clearance when the latter are placed on the rack. Check this dimension on the tables before cutting the longitudinals and adjust the length of them if necessary. Since $\frac{1}{2}$ -in. finished-size stock for the longitudinals may be difficult to obtain, $\frac{3}{4}$ -in. material can be used for all members to save time. When installing the casters on the rack, it is advisable to file or grind off the teeth on opposite sides as shown, to avoid splitting the leg ends. Rubber-headed tacks nailed on the upper edges of the end pieces spaced $3\frac{3}{8}$ in. apart help to keep the tables in position on the rack when it is being pushed.

Before applying a finish to your tray set, sand all surfaces with fine-grit sandpaper and dust with several changes of cloths. For a natural finish, apply two coats of sealer, rub with steel wool between coats and apply furniture wax. If a more durable finish is desired, apply a coat of sealer, sand with 6/0 garnet paper and follow with two coats of varnish. If stain is applied, follow with two coats of varnish and finish with wax. Spar varnish is best for a set that is to be used outside much of the time. For a painted finish, select a good grade of high-gloss enamel or lacquer of the desired color and apply enough coats to produce a mirror-smooth surface. ★ ★ ★



Pincushion Glued to Caster Cup Used as Dress-Pattern Hold-Down

To speed the job of pinning pieces of a pattern to the material, one enterprising amateur dressmaker glued a pincushion to a rubber caster cup as shown and used it as a hold-down. The flat, non-skid surface of the cup and the added weight helps to keep the combination pincushion and hold-down in the position placed on the pattern.

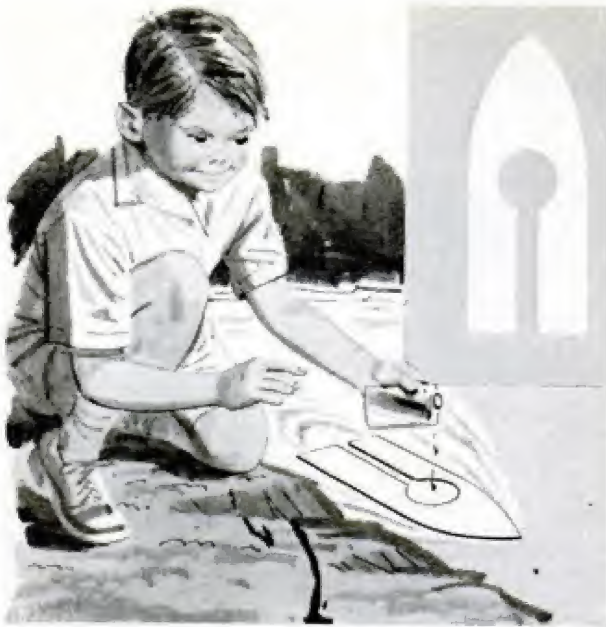
D. Spichuk, Brooklyn, N. Y.



Reflective Tape on Flashlight Makes It Easy to Find in Dark

When there is need for a flashlight or other type of portable, battery-powered light, usually it is too dark to locate by sight. To make such lights "visible" in the dark, simply apply a strip of reflective tape on the case, encircling it as indicated in the photo below.

R. M. Woodbury, Natick, Mass.



Oil Spreading on Water Drives Model Boat

Small boys will find hours of entertainment with this "jet propelled" boat. The boat is made of thin wood with a keyhole-shaped section cut from the center. A few drops of oil placed in this cut-out section will tend to spread and escape to the rear. This will force the boat forward and cause it to skim along the surface of the water.

To renew the worn rubber tips of a movie-camera tripod, give them a heavy coat of liquid rubber. Apply the rubber directly from the tube. If several coats are needed allow each to dry before adding another. Place the tips in a warm place overnight to cure the rubber.



Tool Handles Wrapped in Foil Remain Free of Paint and Tar

On a roofing or painting job, you can prevent the handles of your tools from becoming smeared with paint or tar by covering them with a piece of aluminum foil. The foil can be slipped on in a second and is as easily removed. In most cases the foil will stay in place once it is tightly wrapped but it can be further fastened with rubber bands if desired.

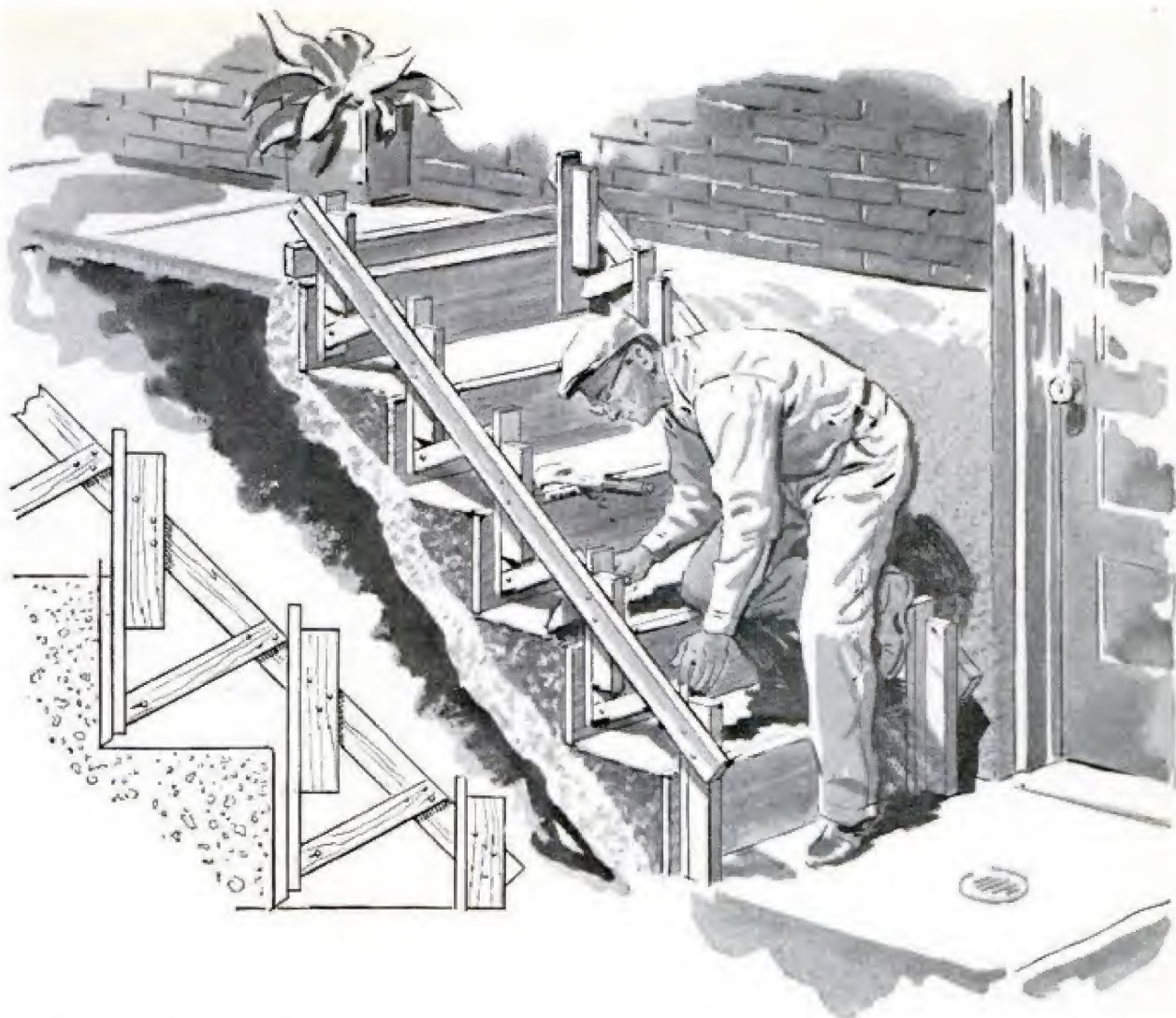
When painting your house, play it safe and position the ladder so that the distance from the base of the ladder to the house is equal to about one quarter of the height of the ladder.



Electrical Junction Box Holds Spare Fuses

You can use an electrical junction box as a holder for spare fuses by removing the knock-outs from the sides. Screw the junction box somewhere near your electrical switch box and insert the spare fuses in the holes. The next time a fuse blows there will be no need to search as the spares will be there where you need them.

Tight and sticking drawers should not be planed because subsequent contraction of the wood may make the drawer too loose. It is best to sand the edges of the drawer lightly and either apply a bit of powdered graphite or rub the edges with soap.



Solid-Unit Form for Pouring Concrete Steps

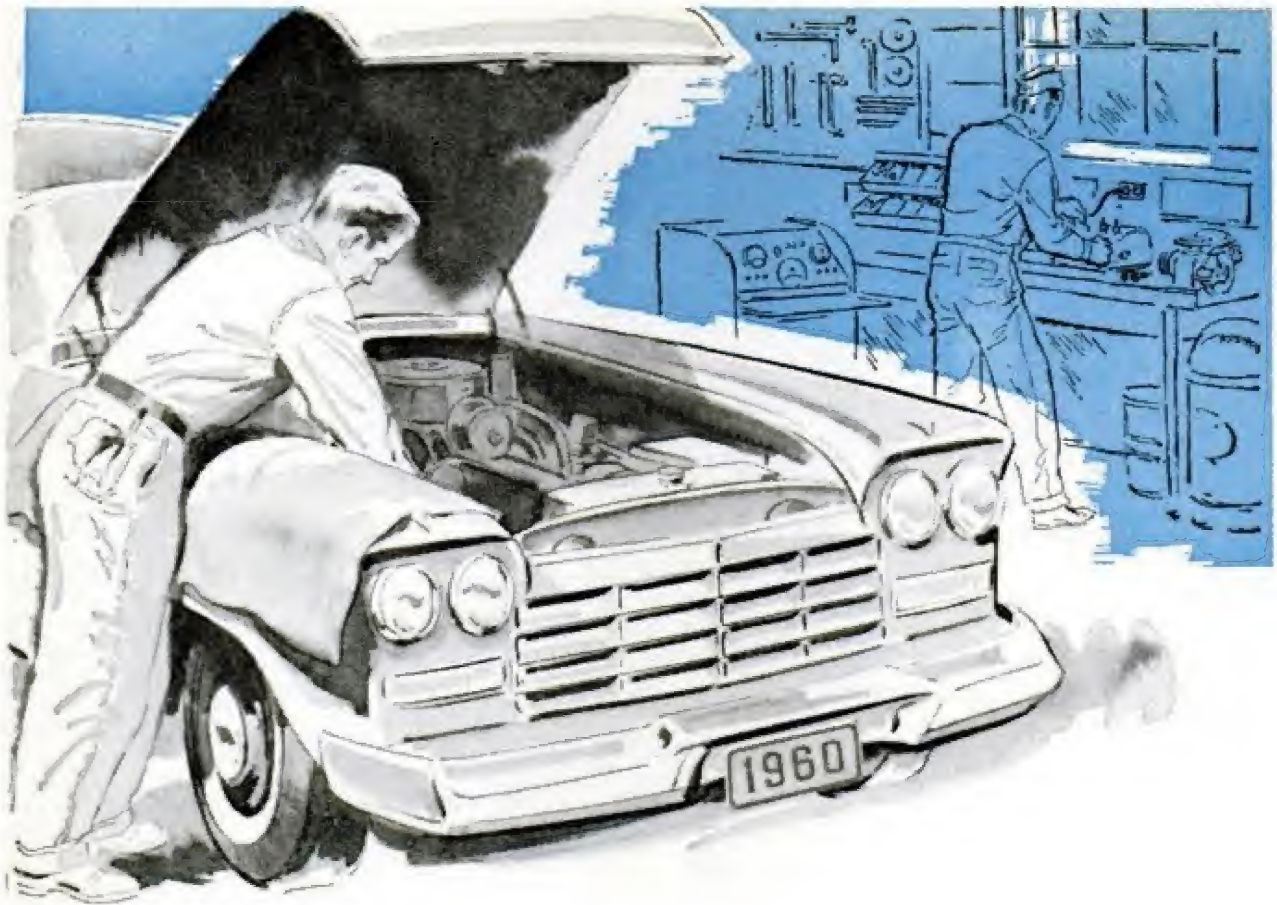
Pouring concrete steps is not difficult if this solid-unit form is used. The form is made of stringers and cleats of 2 x 4-in. stock, and risers of 2-in. stock. The braces are 1 x 4-in. scrap cut to the necessary length. A riser height of 9 in. and a tread width of 12 in. are recommended. Begin by chalking an outline of the steps on the wall along which the steps are to rise. Use this as a guide by which to indicate on the

stringers the angle and location of the risers. Using these guide lines, nail the cleats to the stringers and mount the stringers one on either side of the stair well. Secure them at the top as illustrated and at ground level with stakes driven into the ground. Nail the risers to the cleats as shown in the drawing, with vertical and diagonal braces. The form is now a solid unit ready for the concrete.

Knob on Carpenter's Square Makes Handling Easier

Fitted with a small wooden knob, a carpenter's square is easier to lift from a flat surface or to move into various positions on the work. Screw a threaded rod into an undersized hole drilled into the knob. Cut the extending portion of the rod short and screw it into a hole tapped in the square. Then file the rod flush with the surface of the square.





Trouble Shooting THE TOUGH ONES

By Ben L. Davis



CAN ONE CYLINDER in an engine produce pinging? A recent experience with a '57 Plymouth V8 taught me that it certainly could. The engine had just been given a tune-up job, yet at normal running temperature and a fair amount of acceleration it produced an odd noise, like a marble rolling in the air cleaner. Since the engine didn't run hot, overheating could be written off as the cause. Deciding on a quick recheck of the whole tune-up job, I first checked the carburetor, but an analyzer indicated normal functioning. Next the timing was rechecked, but a stroboscope test okayed the ignition at idle and for degree of advance. A machine check of the distributor got me nowhere. By this time I was becoming a bit irritated. Whatever its source, the noise was not due to carburetion or timing. Of course, improper choice of plugs or faulty setting could cause the pinging. I started checking the plugs and they seemed all right until one of them in the right bank came out minus its gasket. I thought little of this until I inserted a magnet in the plug seat and came out with not one, but *two* gaskets. Here, then, was the trouble. The extra gasket lifted the plug away from its proper seat and cooling surface. The plug ran hotter than it should have and caused the noise.

Unusual Locations Where Trouble May Occur

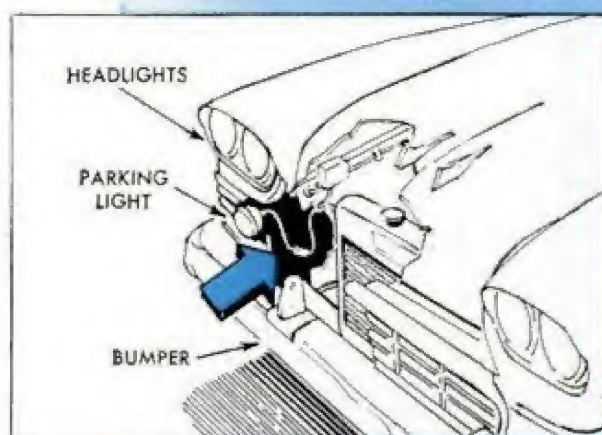
Bumper Guards

Though they were meant as a means of protecting the front end of the car, the bumper guards of the '54 Plymouth are designed with such an angle that it is easy for another bumper to ride over them with possible damage to the grillwork. This is especially true in tight street-parking conditions. The cost of replacement with guards having a more suitable angle may prove to be money well spent.



Rusted Parking Lights

Among the many little things that automobile designers cannot foresee but which mean headaches to the car owner are the wires leading to the parking light sockets of the '58 Rambler. Water running down these wires is likely to rust out the sockets and make their replacement necessary. To prevent this, the wires should be repositioned in such a fashion that the water runs away from the sockets and not down toward them.



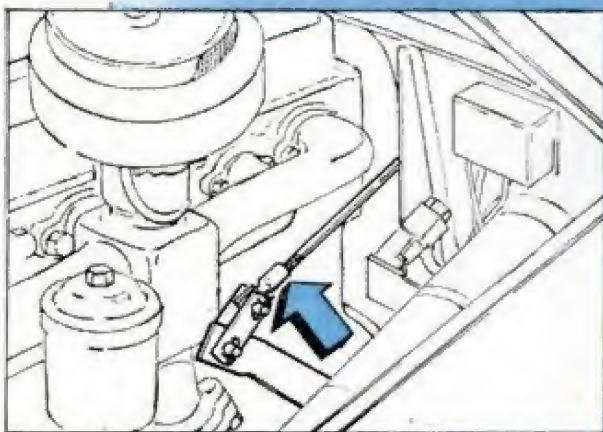
Cooling Fan

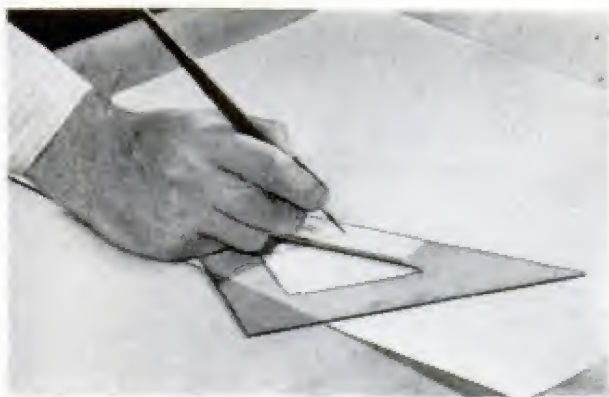
If your '57 Buick consistently runs hot and there is nothing in the cooling system which will bear the blame, check to see that an inadequate fan is not the cause of your problems. It is possible that the car may be still equipped with the four-bladed factory original. Replace this old one with a new five-bladed unit available at your dealer and your cooling problems will be as good as over.



Loose Handbrake Lever

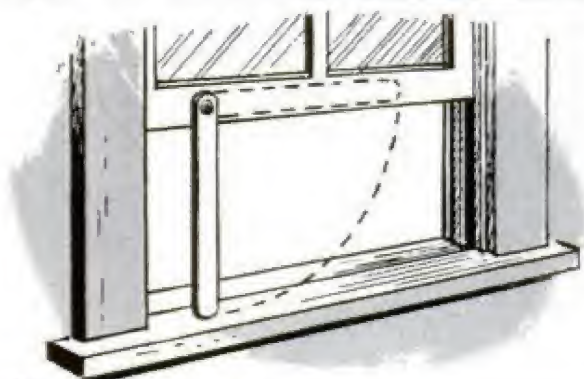
It is a good idea to check the lever of the handbrake mechanism on the '54 Chevrolet. It sometimes comes loose from its threaded link. To prevent this from happening, screw the lever in tight. Then drill a small hole through both lever and link and insert a $\frac{1}{16}$ -in. cotter pin. The mechanism will continue to operate efficiently with no possibility of its ever working itself loose.





Tape and Sandpaper Are Aids For the Busy Draftsman

The busy draftsman will find that a piece of adhesive tape placed on one side of his triangle provides a convenient surface on which to wipe the lint and dust from the point of his pen. A piece of sandpaper can also be placed on the triangle to help keep a sharp point on drawing pencils when fine, precise work is to be done.



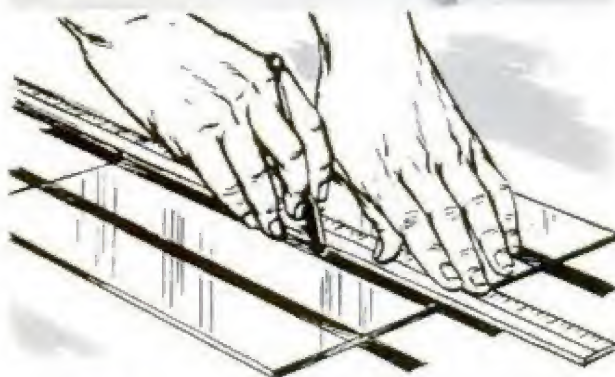
Permanent Barn Window Support Swings Away When Not in Use

If a piece of wood of suitable length is screwed to the bottom of the sash of a barn window, it will serve as a permanently available support with which to prop the window open. It may be swung down when the barn is to be ventilated, or pushed up to a horizontal position and out of the way when it is not in use.



Adhesive Tape Is Guide In Using Stapler

When it is necessary to staple a number of pages at exactly the same distance from the edge of the page, a piece of adhesive tape placed at the desired point on the stapler will act as a guide. The tape can be removed if desired or left in place for future use. A wider piece of tape can be marked with the spacing needed for several different stapling jobs.



Simple Aids and Hints For Cutting Glass

A piece of glass will not slip as you attempt to cut it if two strips of rubber tape are first placed on the workbench. Two strips of wood about 12 in. long, nailed at right angles to a top corner of the bench will also keep the glass from slipping and help you align it for straight cuts.



The Easy Way to Accuracy On a Paper Cutter

Tacks used as stops assure accurate measurement when you cut a number of photos on a paper cutter. Insert the tacks part way into the table the desired distance from the cutting edge. To keep from marring the table with tack holes, use a strip of heavy illustration board instead. Glued to the table, it can be ripped off later and the glue washed off with warm water and soap.



Water "Piped" From Well to Pasture

While temporarily pasturing a cornstalk field where water was unavailable for the cattle, one farmer "piped" water in from a well in a pasture across the road, as shown in the illustration. From the well the water was carried by means of a pipe laid across the ground. To solve the problem of crossing the road with the water line, several

feet of ordinary garden hose were used at this point. The hose was laid across the road when the tank was being filled and removed and hung on a nearby fence post when not in use. Before doing this, permission should be obtained from the local highway authorities.

A. M. Wettach, Mt. Pleasant, Iowa

Watering Trough for Sheep Made of Tub and Odd Parts

A watering trough suitable for sheep can be made out of a washing-machine tub and a few odd pieces of plumbing equipment. Mount the tub on a water pipe, as shown in the photograph below, and fit it with an automatic float valve to keep the water level constant. An electrical heating unit may then be suspended in the water and plugged in during the severe winter months to keep the water from freezing.

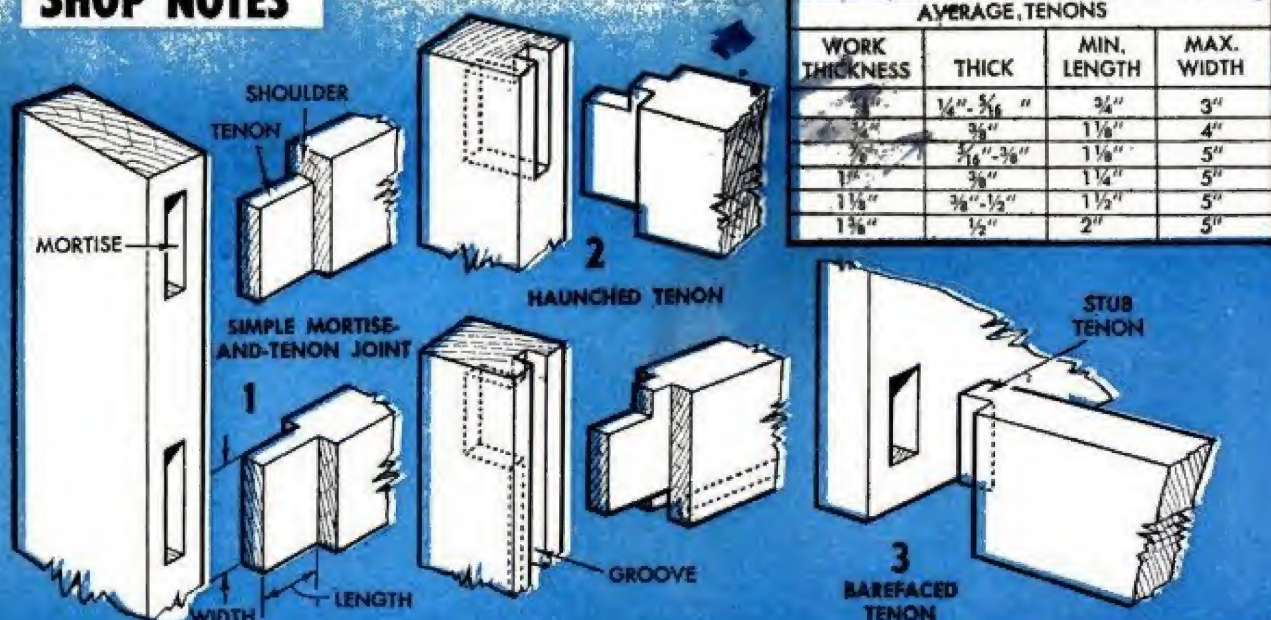


Trough Filled Automatically From Tank Wagon

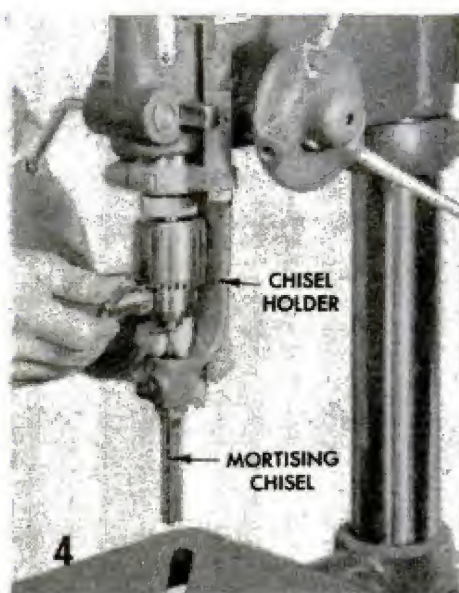
To keep hogs on pasture supplied with fresh water with a minimum of attention, one farmer has connected a trough to a tank wagon by means of a hose. A float valve in the trough holds the water level low so that a steady supply prevents an accumulation of water from becoming stale. Bolted to a slightly elevated platform, the trough is held level and is kept free of mud and trash.



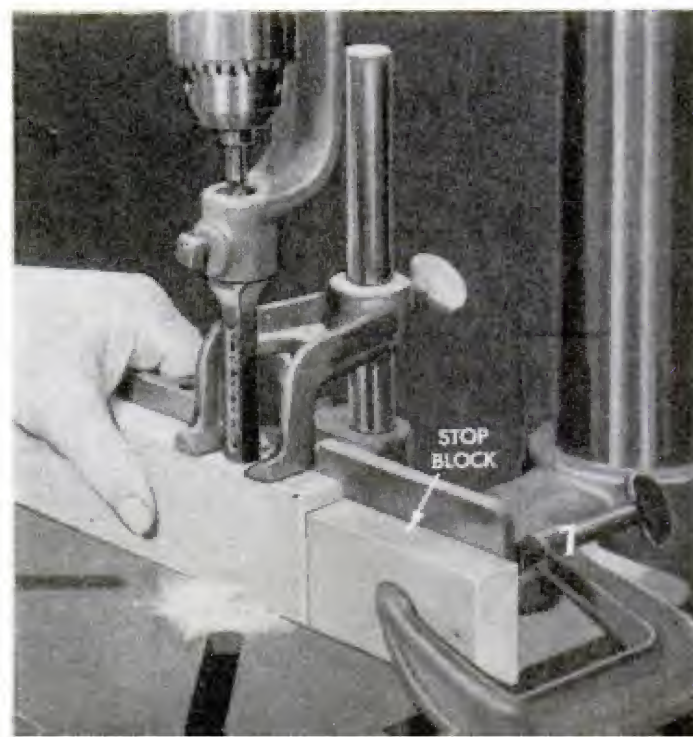
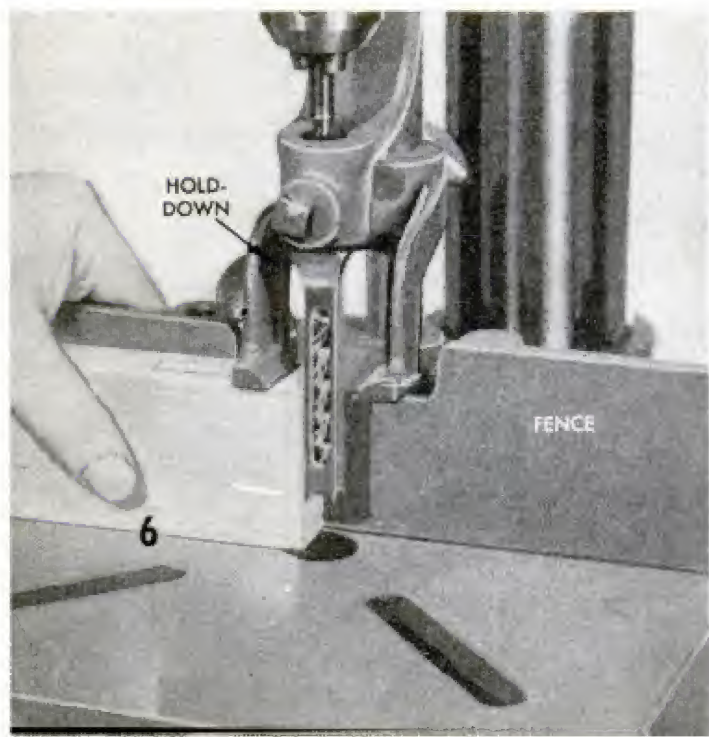
SHOP NOTES

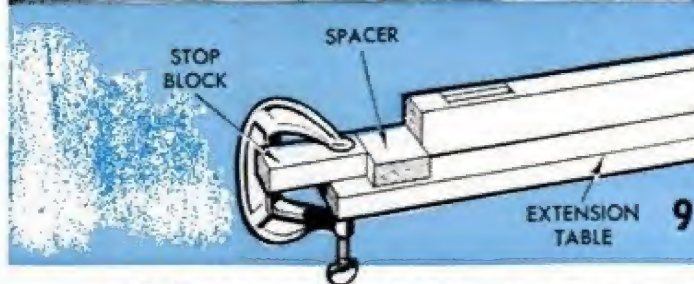
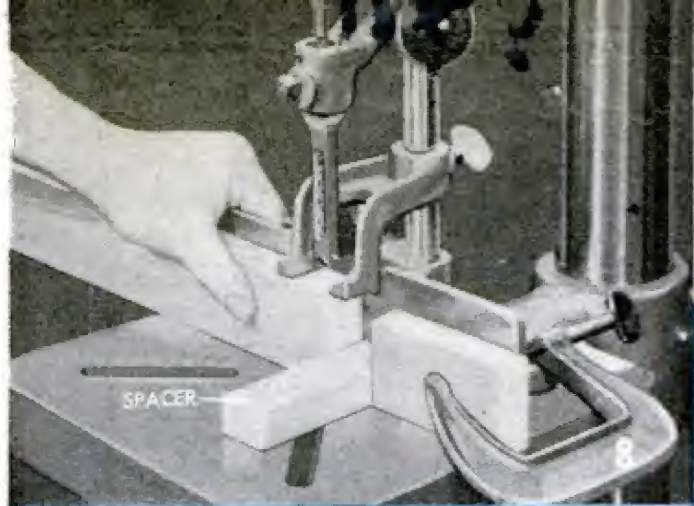


HOW TO CUT MORTISE-



TWO TOOLS, a circular saw and a drill press, make you the boss of the strongest joint in woodworking—the mortise and tenon. Possessed of many variations, the simpler styles shown in Figs. 1, 2 and 3 are most useful. The simple mortise and tenon, Fig. 1, is used extensively in framework construction, such as kitchen cabinets. When the rail stock is narrow, a haunch (shoulder) often is added to prevent twisting, Fig. 2. The haunch also is used as an automatic "fill" for the groove in making paneled frames. When the groove is the same size as the tenon, all the stock is grooved as a first operation, after which the mortises and tenons are made. If the groove is narrower than the tenon, it should be run last, stopping the





AND-TENON JOINTS

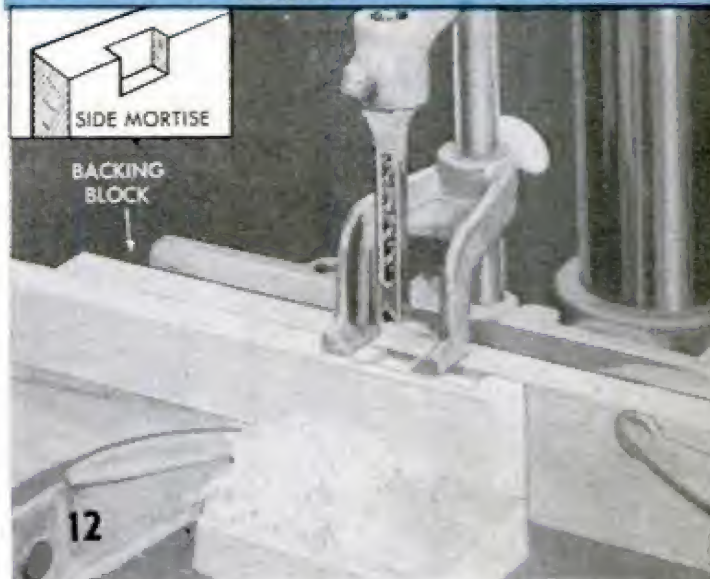
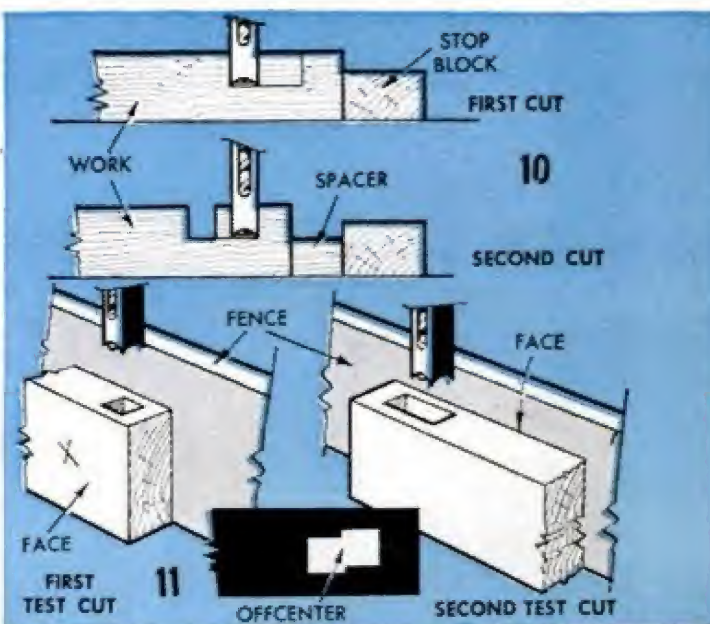
By
Sam Brown

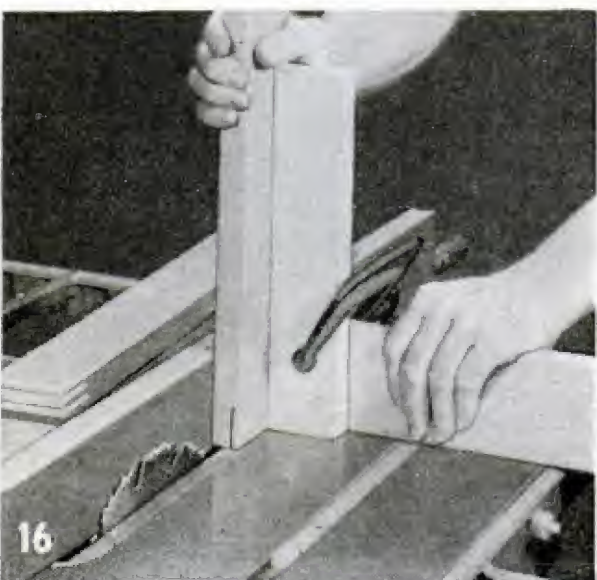
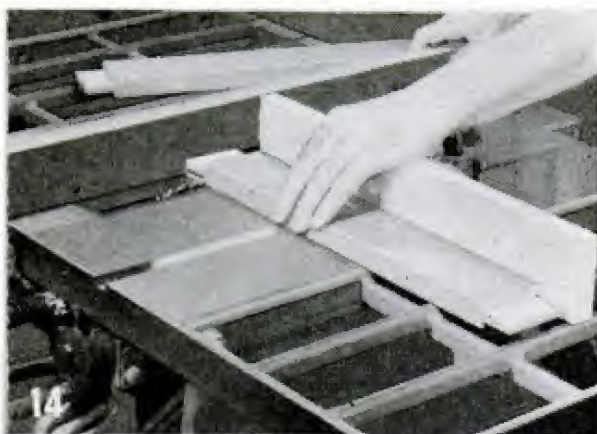
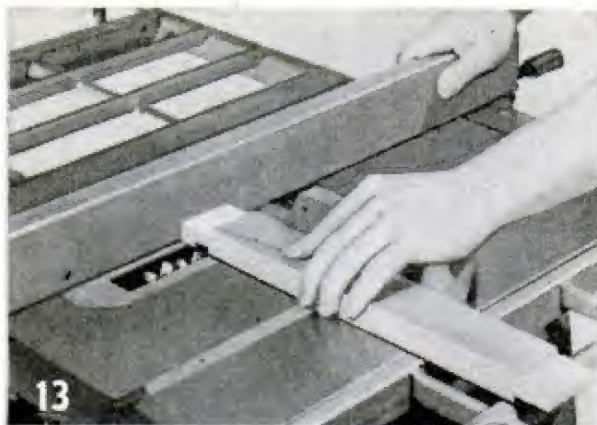
cuts short of the ends of the work. The barefaced tenon, Fig. 3, is often used in cabinet construction having plywood ends.

Average dimensions for tenons are given in the table. The general rule is to make the tenon thickness $\frac{1}{4}$ to $\frac{1}{2}$ the thickness of the work stock. Tenon width and length can vary greatly but the width should not exceed 5 in. If a wider tenon is needed, it should be divided into twin tenons with a space between to avoid a weak mortise.

The mortise usually is cut first because its width is nonadjustable, whereas a tenon can be sawed fat or thin as needed. Mortising is done on the drill press with the use of a mortising chisel fitted in a special holder. The chisel is mounted first, after which the bit is slipped inside of it, Fig. 4, and held by the chuck. A clearance of about $\frac{1}{2}$ in. between chisel and bit is needed to prevent overheating, Fig. 5. The drill press should run at 1800-2800 r.p.m. for softwood; 900-1400 r.p.m. for hardwood.

A mark should be made on the work to show the required depth of cut ($\frac{1}{8}$ in. deeper than the tenon length) and the depth stop is set to maintain this depth, Fig. 6. From here on the procedure will vary with the job. Most work will have four or more similar joints to be made. When this is the case, the required guide marks should be penciled on one master piece, which is used in making the required drill-press and saw settings. All similar cuts should be made at the same time. Cutting similar mortises is done with the use of a stop block and spacer. The first chisel cut is set by a stop block, as in Fig. 7; the





cut is set by a stop block as in Fig 7 the
 opposite end of the mortise is located by means of a spacer, Fig. 8. The width of the spacer is the length of mortise minus the width of the chisel, as can be seen in Fig. 10. After the two end cuts are made, the wood between can be cut out by taking successive bites of about $\frac{2}{3}$ the width of the chisel. Extra working room needed for long work can be obtained by clamping a board to the drill-press table in front of the fence, Fig. 9.

Properly positioned, the face side of the work should be kept against the fence for all cuts. However, when you have right and left members, this is not practical unless you set up right and left-hand stops. The simpler way is to center the mortise exactly so that right and left-hand parts can be cut with the same setup, reversing the work, face in and face out. This will produce perfect work provided the work stock is of uniform thickness, which is the usual case. The initial setting of the fence should be checked carefully with test cuts made on a scrap of the work stock, Fig. 11. Make one cut with the face side out, then reverse to put the face side in and make a second cut. If the two show a jog, Fig. 11, it is obvious you are offcenter.

The side mortise, Fig. 12, is a housed joint rather than a mortise and tenon. However, it is cut with the mortising chisel and is often used in frame construction. It easily is cut by using a backing block and hold-in, as shown. A good amount of pressure is required in making all mortising cuts, but it should not be overdone. It is better to use a slow, steady feed and it is helpful to lift the chisel frequently. Cutting both end holes first, as shown, is recommended. If you use the alternate system of working from one end to the other, do not make the final cut less than $\frac{2}{3}$ the width of the chisel; a narrow cut tends to "bend" the chisel or to force the work away from it.

All the tenon parts first are cut to net length, including the length of the tenons. Do this exactly, using a stop block for all similar parts. With the stock cut to net length, you can proceed with the tenons. When just a few tenons are needed, the system of flat sawing with the dado head, Fig. 13, is reasonably fast and perfectly safe. Even a single saw is not too slow for just a few pieces, although this cut normally is used only for the shoulders, Fig. 14. The minimum safe setup to saw the cheek cuts is a high fence and pushboard, as shown in Fig. 15. Somewhat better is the miter-gauge facing in combination with a clamped upright and the regular fence, as shown in Fig. 16. This gives support in all directions and is fast and safe. Naturally, if you do a lot of tenon work, it is worthwhile to make or buy a regular tenoning

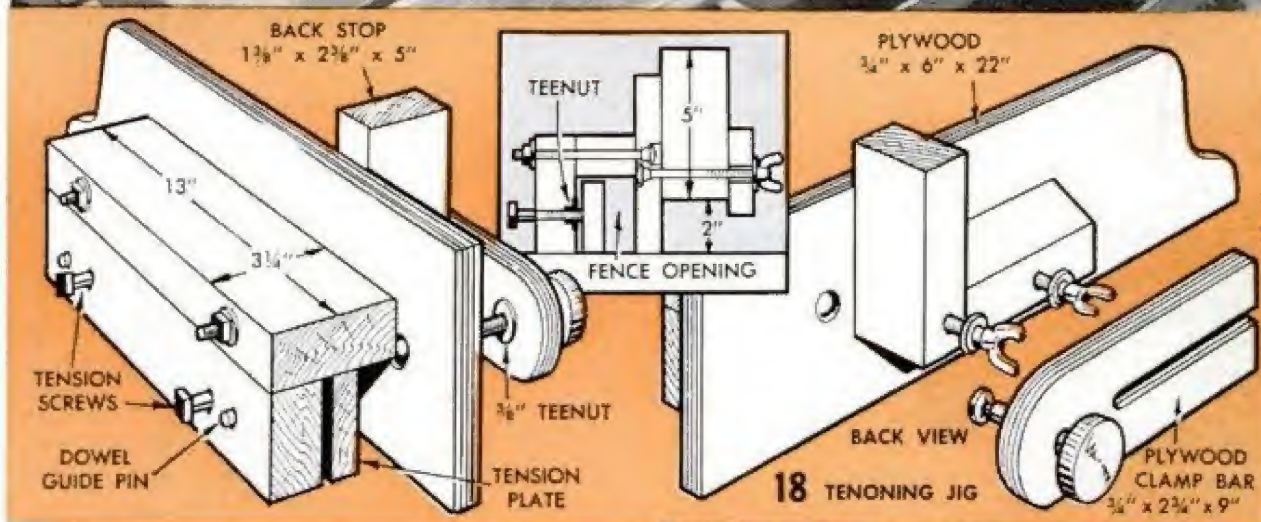
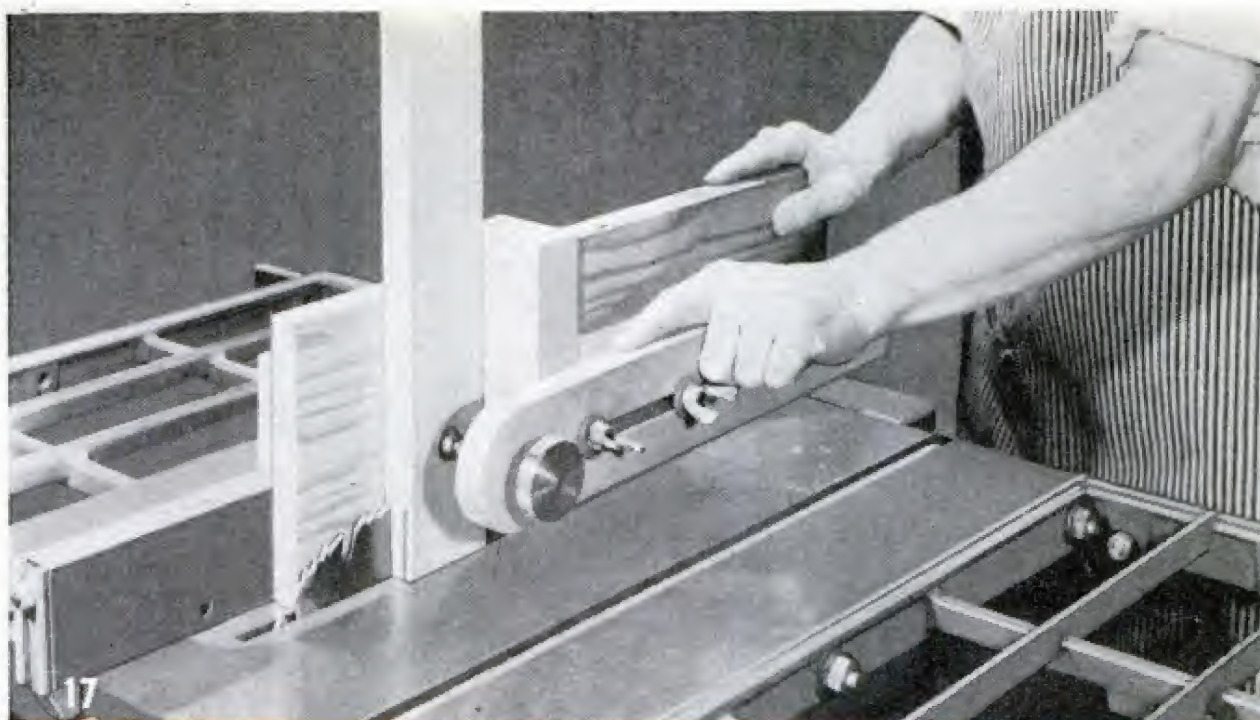
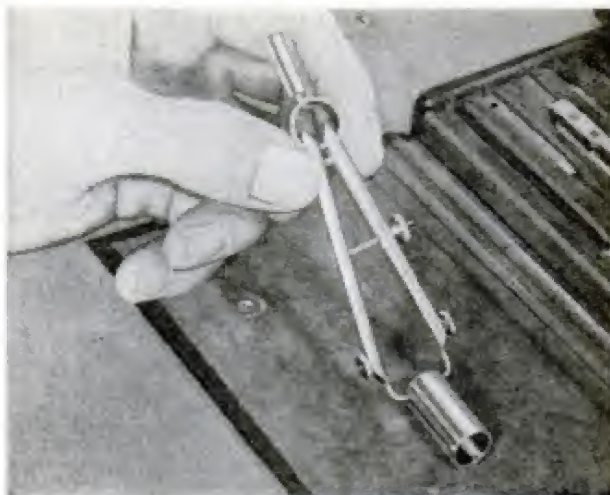


fig. A good homemade fence-riding style is shown in Fig. 18. It is fitted with a tension plate so that it can be made an exact snug, sliding fit on the regular fence. Even without the clamp bar, Fig. 19, it is much better than the high fence and pushboard idea.

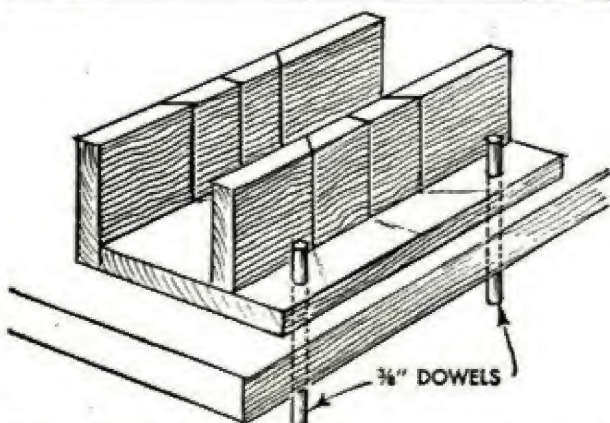
Tenons should be made a good press fit. Like other operations, all similar pieces should be cut at the same time. In the usual method of working, the stock is turned face out, face in for the two cheek cuts. This will produce uniform tenons provided the stock is of uniform thickness. Of course, you can make a test joint first, adjusting the fence carefully to make a tenon which is too large for an easy hand fit but goes together nicely with a few taps of a mallet. The cheek cuts are usually made first in order to preserve maximum end surface to ride on the saw table. The shoulder cuts are an easy job and can be set to length with the regular fence, Fig. 14, or as in Fig. 20 with a stop block fastened to the miter-gauge facing. ★ ★ ★





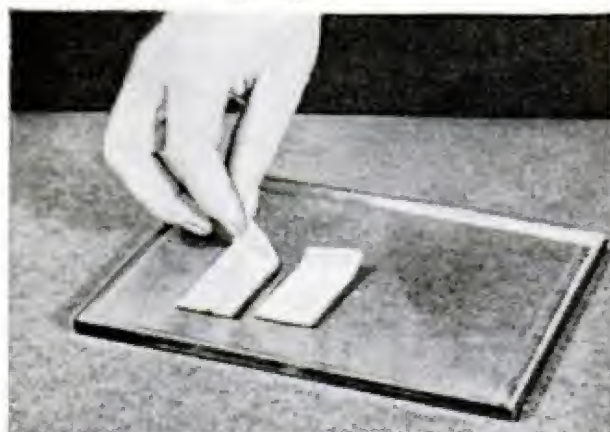
Dividers Become Calipers For Small Precision Work

If you are doing small precision work, a fine pair of calipers can be made by converting the bow dividers of a drafting set. The points of the dividers are replaced with curved wire tips cut from the ends of ordinary paper clips. Be sure to make the tips of equal size. The calipers may be used for either inside or outside measurement simply by reversing the tips as the job requires.—R. Hanscom, Elmhurst, Ill.



Dowels Hold Miter Box Firmly on Workbench

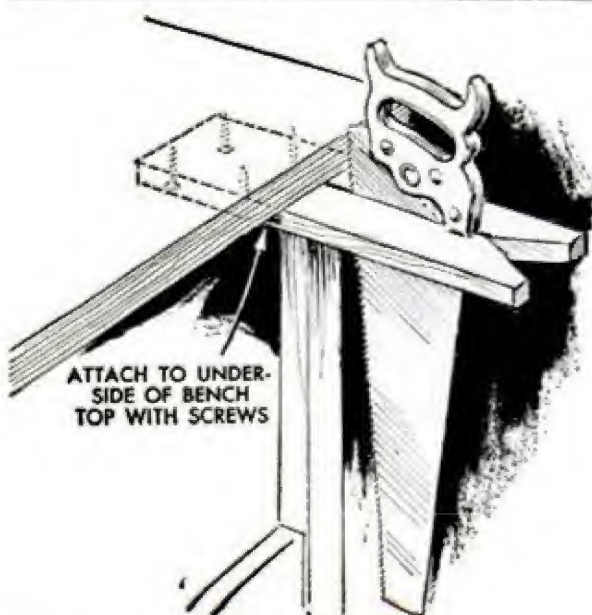
Your miter box won't slide around on the workbench when in use if it is held fast with two or three dowels. In making the box, allow the bottom piece to project an inch or two along one side. Drill holes through this piece and into the bench so that snug fitting dowels may be inserted. Make the holes in the box slightly larger so that it may be removed when not in use.



Precut Tape Placed on Glass Simplifies Wrapping Problems

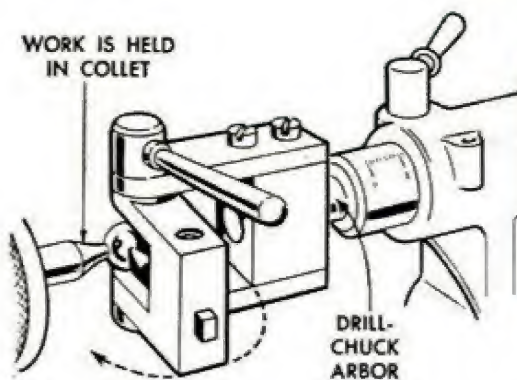
Wrapping and packaging is made easier if the tape is first cut into strips of the required length and placed on a sheet of plate glass. The glass has no effect on the tape's adhesive quality and the strips are available as needed. This leaves both hands free to tackle the packaging job.

Michael Ligocki, Gary, Ind.



Workbench and Odd Corners Make Storage Nooks for Saws

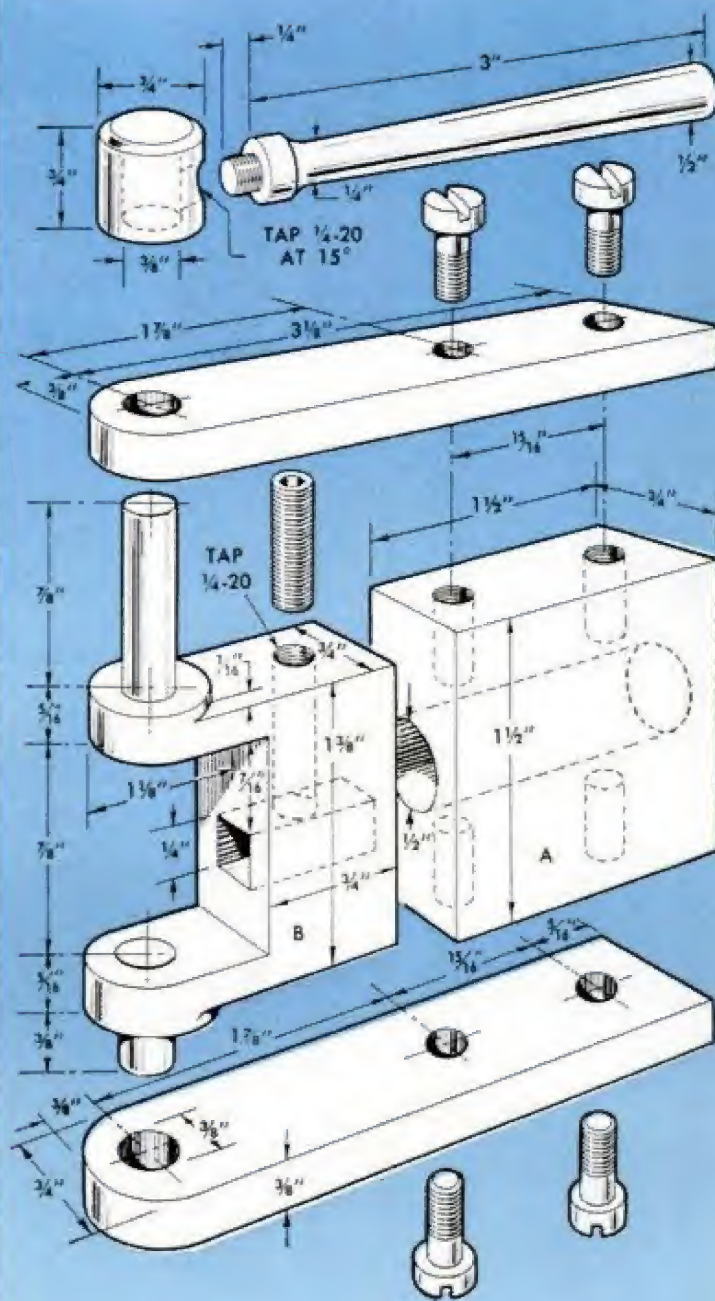
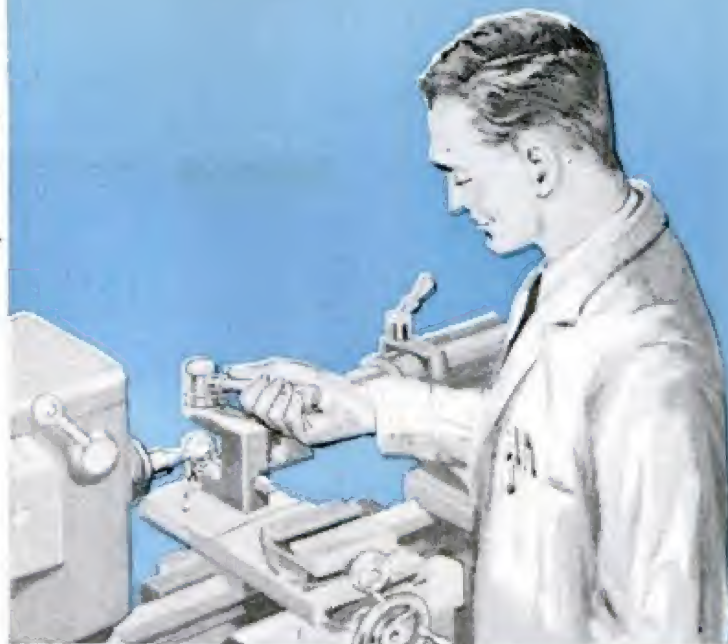
To keep a handsaw conveniently at hand place it in a slotted board attached to the underside of the workbench. This keeps the saw from "wandering off" and insures against the chance of its being dropped and damaged while a job is in progress. If your shop is equipped with several saws, a longer board may be required or they may be stored in a slotted shelf placed against one wall. If wall space is limited, and a board projecting from the bench is in the way, bend a brass rod about 3 ft. long at right angles and attach one side to a board. The board may be mounted on the wall at eye level and the saws hung from the rod by their handles.



RADIUS TURNING TOOL

TURNING perfectly shaped balls or other spherical work is no trick at all with this radius tool which mounts in the tailstock. It will turn a ball from $\frac{1}{8}$ to $\frac{3}{4}$ in. in diameter by a mere swing of a handle. It does away with difficult lateral adjustment since the cutting edge of the tool is set permanently at exact lathe-center height and the tool itself is automatically aligned with the lathe centers when it is placed in the tailstock. Longitudinal adjustment is made by advancing or backing off the tailstock quill.

Using the tapered shank from a discarded reamer simplifies the tool, which for the most part, is machined from rounds and flats of cold-rolled steel. The pull-apart drawing dimensions the parts and shows how they go together. The tapered shank is a press fit in part A, and the swivel yoke, part B, pivots freely between extending arms. The square hole for the $\frac{1}{4}$ -in. tool bit can be formed by first boring a hole and then working it square with files. The important thing is the location of the hole. The top of it must be at exact lathe-center height. In use, take very light cuts at high lathe speeds.—C. W. Woodson, Chicago.





Tape Attached to Micrometer Records Measurement Figures

To prevent errors when taking micrometer measurements, jot down the figures on a piece of gummed-paper tape attached to the side of the "mike." When several measurements must be taken, attach the tape to the workbench or to some other convenient surface. Figures written in pencil can be erased and the tape used several times.—H. Hanscom, Elmhurst, Ill.



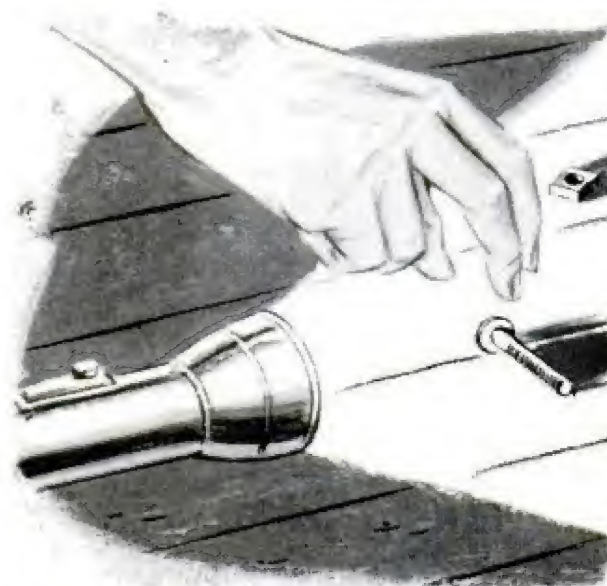
Suspending Brush in Solvent Prevents Bending of Bristles

Paintbrush bristles will become bent and ruined if the brush is allowed to rest on the bottom of a can of solvent. To prevent this, hold the brush against one side of the can with a C-clamp so that the bristles are held above the bottom. Several brushes can be suspended in the solvent if holes are drilled in the handles. Run a piece of wire through these holes and place the wire over the can.—Daniel Bousha, Jackson, Mich.



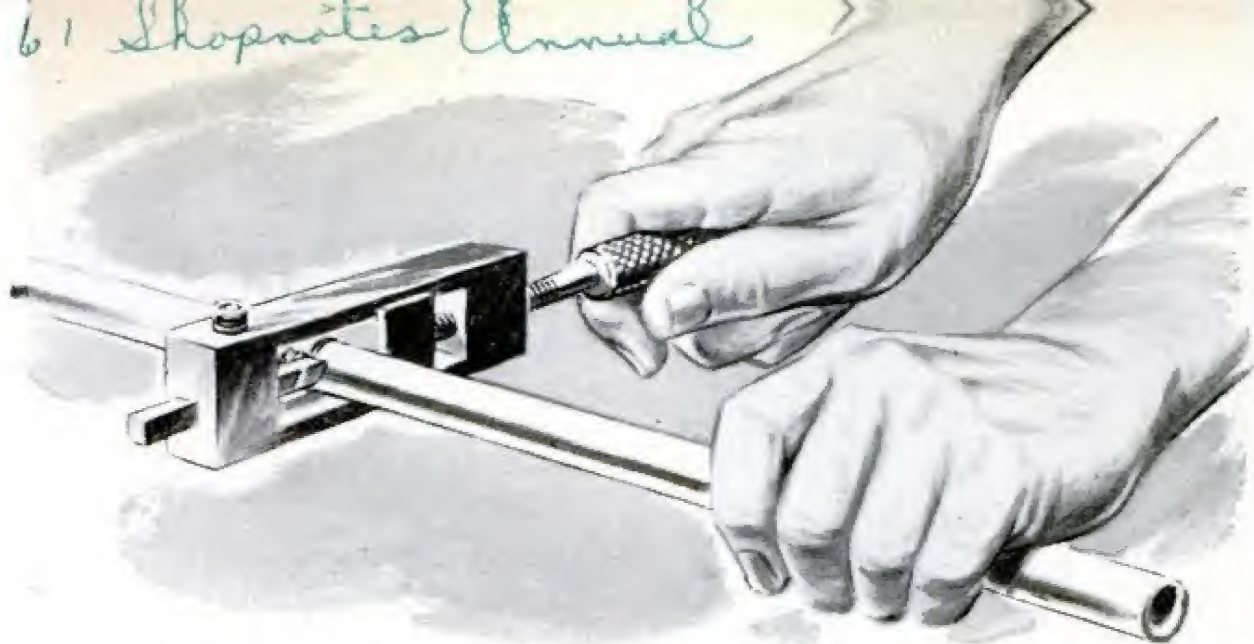
Pad Protects Wooden Floors And Aids Removal of Nails

A simple device makes it unnecessary to mark up a fine wooden floor when removing nails with a crowbar. Wrap a piece of inner-tube rubber around a piece of wood measuring about $\frac{1}{2} \times 3 \times 8$ in. and fasten it with tacks. When removing nails, slip the crowbar under the rubber. The block affords the necessary prying leverage. The rubber holds the block to the crowbar while also serving as a protective pad.



Suggestions for Care and Use Of the Versatile Flashlight

To locate small items, such as nuts and screws when they accidentally fall to the floor, beam a flashlight across the floor rather than down on it. The item will cast a longer shadow and be easier to spot. An old tea strainer, minus its handle, wired to the head of the flashlight will protect the lens against breakage when it is stored with tools. In emergencies, such as roadside automobile repairs, clamp the flashlight into a small wrench and drive the handle of the wrench into the ground. This will hold the light steady and allow you to direct the beam where you need it, leaving your hands free to do the necessary work.

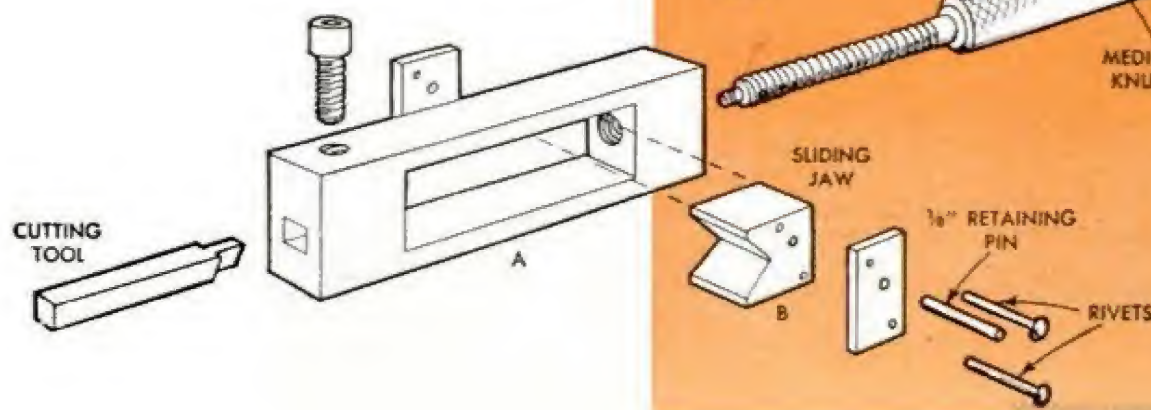
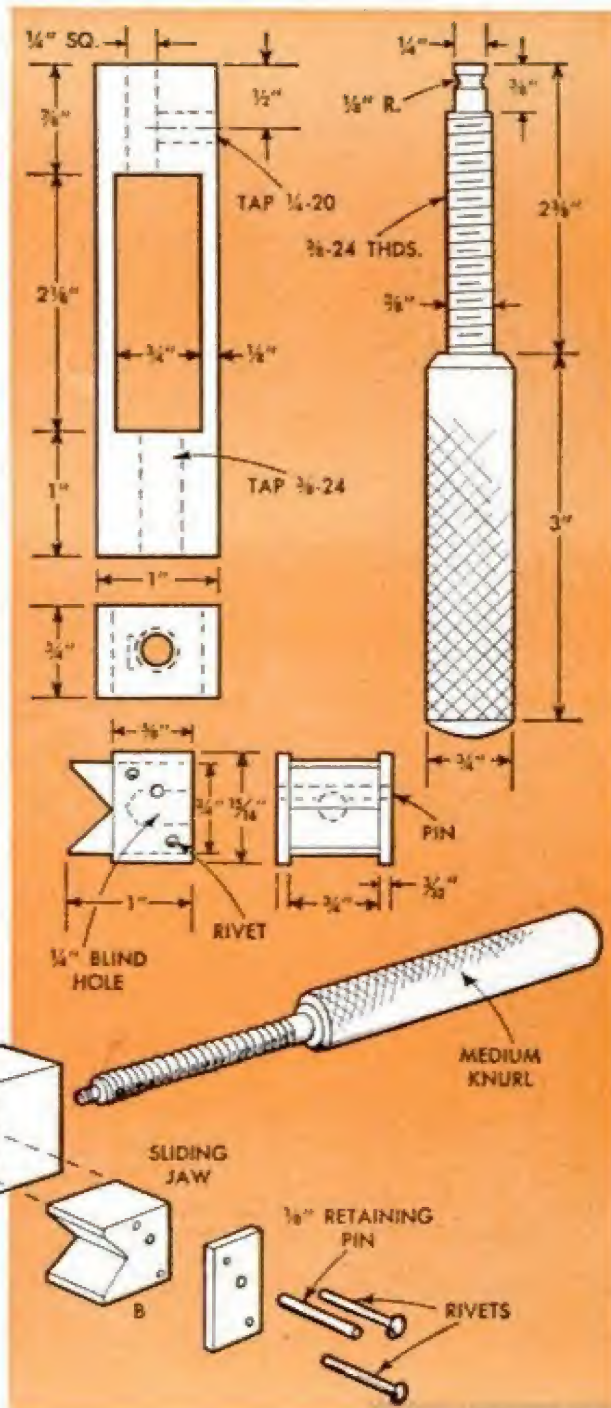


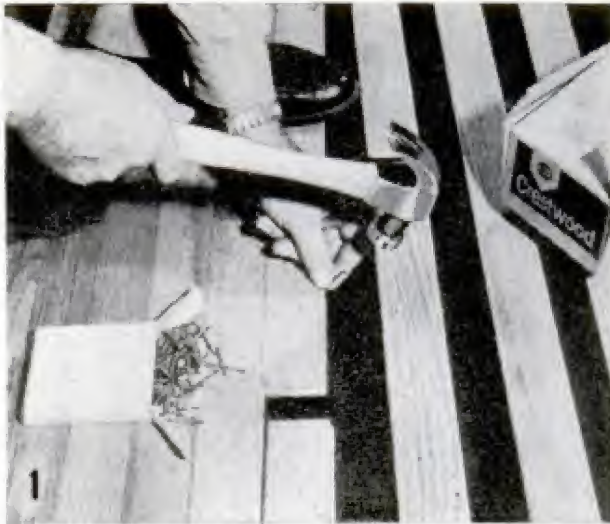
TUBING CUTOFF TOOL

USED in much the same manner as a conventional pipe cutter, this shopmade cutoff tool does a neat job on thin-wall tubing up to $\frac{3}{4}$ in. O.D. Instead of employing cutting wheels, the tool makes use of a lathe tool bit. With the tubing cradled in a V-jaw, pressure is brought to bear against the cutting bit by turning the handle a little at a time as the tool itself is rotated around the tubing. The severed end will be smooth and undistorted.

In making the body of the tool, a 4-in. length of $\frac{3}{4}$ x 1-in. cold-rolled, steel bar is used. The ends are first squared and then a $\frac{3}{4}$ -in. slot is cut in it with an end mill by mounting the work in the lathe milling attachment. After this, the rounded ends of the slot are filed square. Next, one end of the work is drilled and tapped for the threaded shank of the handle, after which the opposite end is drilled and filed square to receive a $\frac{1}{4}$ -in. tool bit. The latter is ground to form a thin-blade parting tool and is locked in place with a socket-head capscrew. The $\frac{3}{4}$ x $\frac{3}{4}$ x 1-in. sliding V-jaw is filed to move freely by two outside members riveted to it to form flanges. The jaw is held loosely to the end of the handle by a cross pin which enters a groove in a tenon turned at the threaded end of the handle.

C. W. Woodson, Chicago





On the MARKET for Do-It-Yourselfers

1. REMODELER'S HARDWOOD FLOORING comes in a nested package containing material to cover 25 sq. ft. of floor area, including cutting waste. Carton also contains correct number of nails and complete installation instructions. Individual flooring boards are $\frac{3}{4}$ x 2 in. sectional size, are prefinished and come in random lengths. Cartons are 8'-2" long

E. L. Bruce Co., Memphis 1, Tenn.



2. PAINTBRUSH CLEANER removes oil and latex paints, and all ordinary enamels and varnishes from brushes. Brush is simply dipped in cleaner and then rinsed under water faucet. Product also can be used for reconditioning brushes in which paints and varnishes have hardened over a long period of time. Simply soak brush in cleanser and rinse in clear water. Enterprise Paint Mfg. Co., 2841 S. Ashland Ave., Chicago 8, Ill.

3. PRECUT WOOD PICTURES are now available as kits in a wide range of subjects. Parts are keyed and are cut to exact size so that they fit together in a manner similar to the parts of a jigsaw puzzle. All that is necessary is to glue the parts of the picture to a panel which is furnished with the kit. Light sanding and finishing brings out color of woods

Albert Constantine & Son, Inc., 2050 Eastchester Rd., New York 61, N. Y.

4. READY-MIXED WALLPAPER ADHESIVE can be used when hanging nearly all types of wall coverings such as common wallpapers, grass cloth, silks and vinyls. Will not cause stains, even when work is done during periods of high humidity when slow-drying characteristics of ordinary pastes sometimes soften color pigments used in design patterns of wallpapers

Resistance Coating Corp., 906 Nepperhan Ave., Yonkers, N. Y.





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5. LIQUID GOLD-PLATING SOLUTION plates nearly all common metals except aluminum and stainless steel. Plating is done without electricity or any special equipment. Plating time is about three minutes and of course the coating will not corrode or tarnish if the necessary steps in the plating process are properly carried out. Especially suited to plating small objects such as jewelry fittings, medals, buttons, etc.

Panther Products, Inc., 2165 Morris Ave., Union, N. J.



6

6. CORRUGATED METAL ROOFING is now being supplied in 31-ft. rolls. Rolled strips are available in 15 and 30-in. widths. Strips come with integral lap flange crimped 1½ in. wide on each edge. One flange is coated with a mastic material which seals joint in final application. Roofing is simply unrolled and nailed in place as pictured. Material is also finding use as siding, ceiling and ornamental fencing.

Ceco Steel Products Corp., 5601 W. 26th St., Chicago, Ill.

7. PLASTIC TAPE seals worn threads in leaky faucets, shower heads, automatic-washer hose—any threaded connection that must hold water under pressure. Withstands heat and cold in a wide range. Usually a single wrapping of tape will form an effective watertight seal when the thread has been tightened to normal tension. Not affected by sunlight, moisture, or concentrated solvents or acids. Comes in handy roll.

Minnesota Mining & Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

8. MULTICOLOR PAINT is sprayed from a pressurized container and is available in 14 pastel colors that find a wide range of both household and industrial uses. Won't soften previously painted surfaces, dries quickly to a smooth, nontextured finish that can be recoated with a solid color whenever desired. Coating resists scratching and chipping and is especially resistant to abrasion due to its elasticity.

Benjamin Moore & Co., 511 Canal St., New York 13, N. Y.



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8



CLAMP FIXTURE

Holds Round Stock For Machining

By Robert Hill

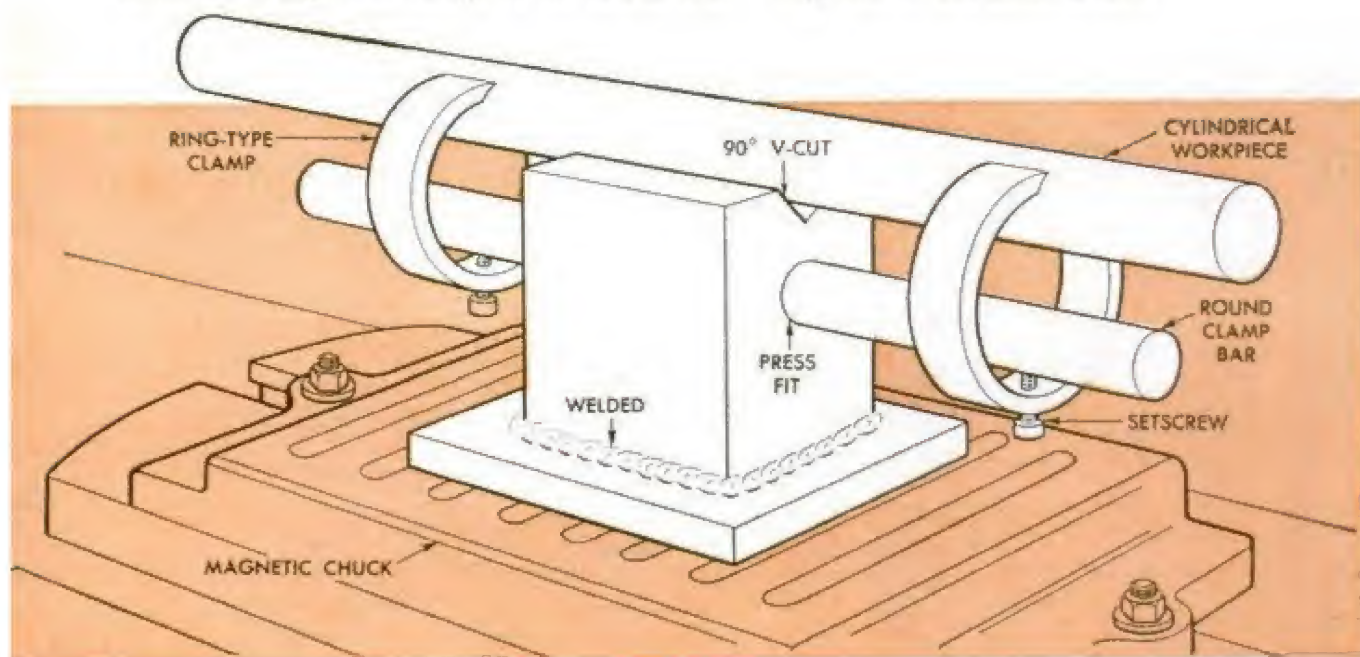
I HAVE TRIED several suggested methods for holding round stock for machining but none of them proved more reliable than the fixture shown. There are no difficult machine operations involved in making this simple, effective fixture, and the purpose it serves will facilitate many setups on a grinder, drill press and milling machine.

The side surface of the workpiece is completely exposed to action of the cutting tool or abrasive wheel as there are no external clamps to obstruct free movement of the latter. A special type ring clamp, metal block and clamp bar make up the parts. You can use any steel block of suitable size for the body of the fixture and weld a piece of flat steel to it to provide a clamping flange on the bottom of the fixture. The body has a 90 deg. V-slot milled across the top to seat the workpiece. A $\frac{5}{8}$ -in. hole drilled through the flange $\frac{1}{2}$ in. below the

groove takes the clamp bar with a snug press fit. The ring clamps are made on a lathe, although rings cut from a piece of pipe may do on light work.

To make the rings on a lathe, bore out a piece of round stock, boring it to produce rings of the desired size. Then cut off the rings with a parting tool. Width and thickness of the rings will depend on the gripping strength required for your work. Rings $\frac{1}{2}$ -in. thick and $\frac{1}{2}$ -in. wide will handle most work. After cutting off the rings, sections are ground from each one to produce jaws, the ends of which are faced off and made concave so they will hold firmly against the sides of the round workpiece. Setscrews tapped into the rings to bear against the clamp bar provide the clamping force.

On a magnetic chuck the lower flange needs no clamping, but clamps can be used if desired. For a drill-press table or a non-magnetic chuck, standard clamps are required to hold the fixture to the machine table. The fixture unit must be machined square to produce accuracy in the work it holds. When welding the plate to the body of the fixture be careful that the welding heat does not warp the plate. If this happened, the fixture would not hold the workpiece accurately in relation to the cutting tool or abrasive wheel.



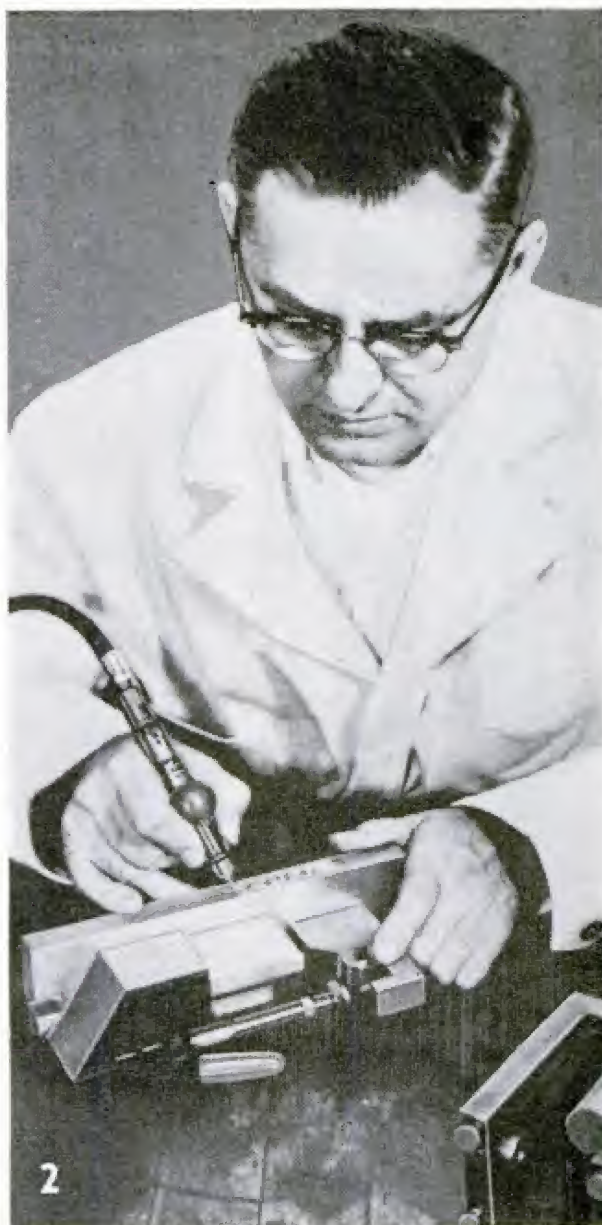


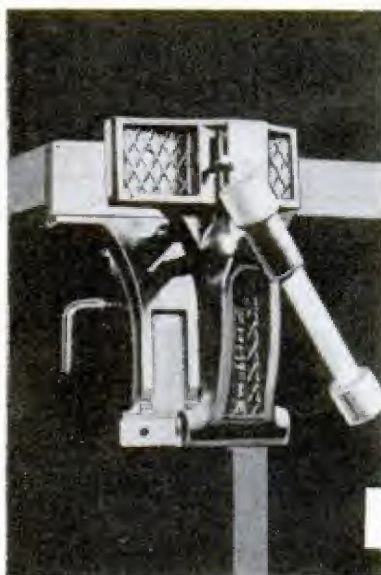
Sheercut Tool Co., 7045 Darby Ave., Reseda, Calif.

Thor Power Tool Co., La Grange Park, Ill.

Karl A. Neise, 404 Fourth Ave., New York 16, N. Y.

Atlas Press Co., 2024 N. Pitcher St., Kalamazoo, Mich.





5. UNIVERSAL TURRET VISE is both a woodworking and metalworking vise combined in a swiveling head that can be locked in either of the two positions pictured. Has 3 x 7-in. woodworking jaws and 1 x 4-in. serrated jaws for metalworking. Holds pipe or tubing $\frac{1}{4}$ to $4\frac{1}{2}$ in. dia.

Wilton Tool Mfg. Co., Inc., Schiller Park, Ill.

6. FLARING TOOL works in a manner similar to an arbor press except that the flaring plunger is hammer actuated. Tubing to be flared is placed in correct size hole in the split block. Flaring plunger is then placed over end of tubing and given a light tap with a hammer

The Schaul Mfg. Co., 6300 Roland Ave., Cleveland 27, Ohio



7. THREAD-MEASURING WIRE CARRIERS for attachment to common micrometers and measuring machines having $\frac{3}{8}$ -in. dia. anvils, were designed primarily for checking wear of thread plug gauges, but also have other applications in inspection. Capacity to $\frac{3}{4}$ -in. dia.

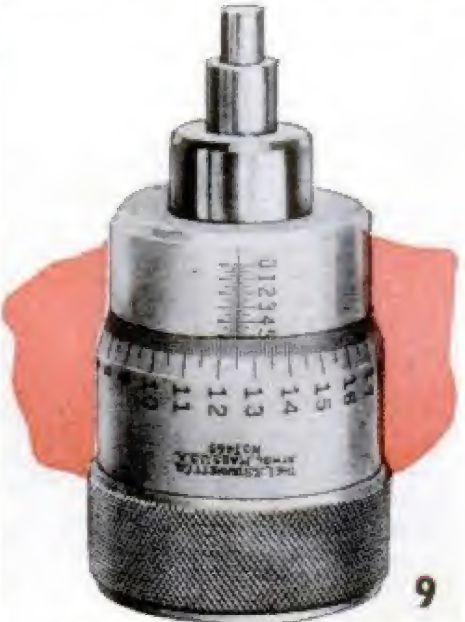
Standard Gauge Co., Inc., Poughkeepsie, N. Y.

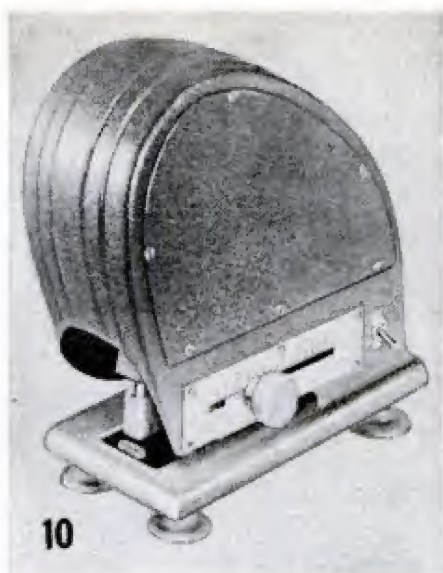
8. HIGH-SPEED SPINNER cleans paint rollers and brushes thoroughly. Paint-laden brush or roller is inserted in spinner, which is then placed in container with solvent. Pulling on nylon cord rotates brush or roller in solvent. Remove brush, pour out solvent and spin dry

The Westway Mfg. Corp., 1100 Columbia Rd., Westlake, Ohio

9. MICROMETER HEAD is designed for use in electronic equipment requiring extra-fine adjustment and also for machine tools, fixtures, special gauges and tools where micrometer accuracy in settings is required. Length with setting at 0 is $4\frac{3}{8}$ in. Thimble dia. is $2\frac{1}{8}$ in.

The L. S. Starrett Co., Athol, Mass.

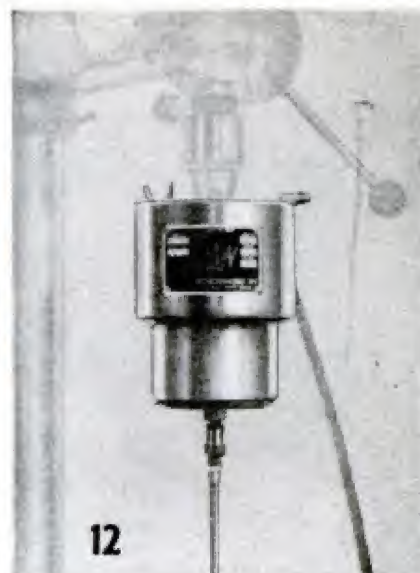




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12

10. AUTOMATIC ELECTRIC STAPLER speeds up the job of stapling correspondence, reports, booklets, paper bags, envelopes, records and any material on typed or mimeographed sheets. Driver is operated by solenoid. Therefore it operates only as work is fed to it
The Staplex Co., 777 Fifth Ave., Brooklyn 32, N.Y.

11. NIPPERS are now available with carbide cutting tips for extra long life on harder materials. The tips, or jaws, are fastened in toothed seats by small screws and may be removed for regrinding after wearing dull. Available with tips for cutting wire and tile
The L. S. Starrett Co., Athol, Mass.

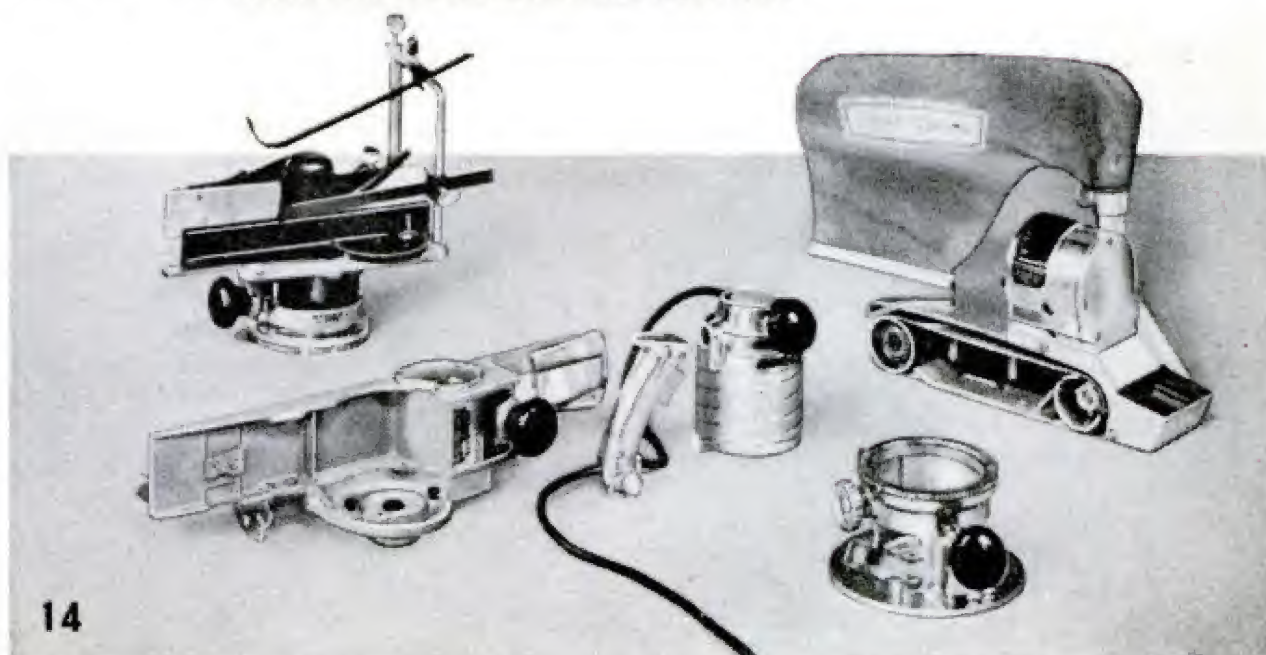
12. METAL DISINTEGRATOR can be used on a drill press, has practical uses in small shops. It does just what its name implies, disintegrates metals by means of a spindle which is vibrated electromagnetically at an extreme rate. Removes broken taps, drills, etc.
Jiffy Disintegrators, Inc., 1503 E. 11 Mile Rd., Royal Oak, Mich.

13. PAINT ROLLER has self-contained paint supply, eliminates need for pans, reduces dripping. Consists of a roller similar to conventional paint roller carried in a special guard, the cap of which screws onto a plastic bottle. Just squeeze bottle to feed paint to roller
Portable Electric Tools, Inc., 320 W. 83rd St., Chicago 20, Ill.

14. PORTABLE TOOL KIT consists of motor unit and fixed handle which is attachable to any one of four units to make a shaper, sander, router, and electric plane. In addition to units pictured there are accessories available which increase range of basic units
Sears, Roebuck & Co., 925 S. Homan Ave., Chicago 7, Ill.



13



14

RADIO TV HI-FI

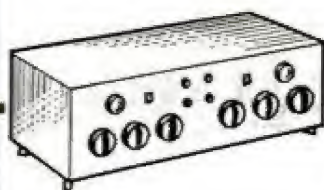
ELECTRONICS



Custom-Built Stereo Fidelity

PART III

Selecting Your Amplifier



By Lothar Stern

WHEN YOU TURN ON the switch of a music system, hi-fi or otherwise, a number of different components go to work for you. At one end of the chain there's the pickup device, a record player, radio tuner or tape mechanism, which converts the energy from a program source (a disc or tape record or a radio signal) into equivalent electrical impulses. On the other there's the loudspeaker which changes these electrical impulses into corresponding sound waves. In between these components there's the *amplifier* which strengthens the feeble signals from the pickup device to the point where they can drive the speaker to the loudness level you want.

Every music system has some sort of amplifier. But while you can spend as little as \$5 for a simple phono amplifier (not hi-fi, of course) you can also lighten your coffers by as much as \$200 without expending any particular effort in that direction. The effort comes in when you try to select the one that offers the most for your money in a system which meets your personalized stereo requirements.

The development of high-fidelity amplifiers has reached a stage where the ear is no longer a good judge of absolute

quality. In contrast with loudspeakers, whose differences are quite audible in a listening-comparison test, the variations between high-quality amplifiers are much more subtle. In fact, any major flaws are likely to show up only after prolonged listening in the home, to a variety of program material. That's why every hi-fi-amplifier manufacturer carefully checks all aspects of his product with elaborate test equipment and makes the results available to the prospective buyer in the form of electrical specifications. Your ultimate satisfaction with the amplifier you buy depends upon your ability to evaluate these specifications and to correlate them to your needs.

Is it hi-fi, or isn't it? Who's to say? What may sound like high fidelity to the tolerant listener may be totally unacceptable to the more astute observer. The trouble is that

the hi-fi industry, as a group, has been strangely silent as to the specifications which constitute real high fidelity. And the absence of any official word has sanctioned the use of the "hi-fi" label on any amplifier barely capable of emitting a squawk.

In this regard, our hat's off to the Heathkit Co. for publicizing a set of standards which reflects its feelings on this controversial subject. The standards omit some vital statistics, but can serve as a guide.

Quality amplifiers, Heath contends, fall into three categories:

PROFESSIONAL amplifiers, which are so nearly perfect that they cause no audible change in the program material.

HIGH FIDELITY units which are slightly less perfect but still introduce no obvious deterioration of the sound.

HEATH-PROPOSED STANDARDS FOR AMPLIFIER CLASSIFICATION

CLASSIFICATIONS	Harmonic Distortion at Rated Power Output	Intermodulation Distortion at Rated Power Output	Frequency Response at Rated Power Output
PROFESSIONAL	2% or less at 20 cps .3% or less at 1000 cps 2% or less at 20,000 cps	1% or less, using frequencies of 60 and 6000 cps, mixed at ratio of 4 to 1	± 1 db from 20 to 20,000 cps.
HIGH FIDELITY	2% or less at 30 cps .7% or less at 1000 cps 2% or less at 15,000 cps	2% or less	± 1 db from 30 to 15,000 cps
UTILITY	3% or less at 60 cps 1% or less at 1000 cps 3% or less at 7000 cps	3% or less	± 1 db from 60 to 7,000 cps

NOTE: Any amplifier that meets professional standards at a certain power rating may have a higher power rating for high-fidelity purposes and a still higher one for utility purposes. A unit which meets neither professional nor hi-fi standards may still be satisfactory as a utility amplifier.

Table 1. There's no definite line between hi-fi and lo-fi. Here's one proposed standard for rating amplifiers

UTILITY amplifiers which meet minimum specifications considered adequate for sustained, satisfactory listening.

The technical specifications considered adequate to meet these standards are tabulated in Table I and interpreted in the pictorial representations and characteristics curves of Fig. 2. They mean simply this:

An amplifier must be able to supply enough electrical power to drive a loudspeaker to full-orchestra volume in your particular listening area. And at the peak of this power, it must not change, add to, or subtract from the program material by a greater amount than specified for the given classifications.

If all manufacturers would agree on a set of standards such as these, or if they would all measure their equipment in the same way, or at least publish their specifications using the same frame of reference,

the selection of an amplifier would be as simple as A, B, C. Unfortunately, this is not the case. In fact, there's a saying in the industry that the last manufacturer to publish his specifications has the best product. The inference is that this data can be colored — confused — to make it look better without actually being false. This being so, you'll have to reduce the variety of data furnished by different concerns to a common level in order to make a wise choice.

The Power Rating. The amount of amplifier power you need depends mainly on the speaker system you select. While the actual sound power developed by a full orchestra, even at maximum volume, may be only a fraction of a watt, loudspeakers are notoriously inefficient devices. The most efficient of them convert only about 50% of the applied amplifier power into equivalent sound. Some of the least efficient units

MEET THE DECIBEL

The apparent loudness of a sound does not change in direct proportion to its power. Because the ear responds logarithmically to a change of power it is necessary to employ a logarithmic standard of measure when describing **loudness**. Such a unit of measure is the decibel—db for short.

When we double the actual power of a sound, we increase its loudness level by 3 db, and this is about the smallest change in volume that can easily be recognized by the average ear. A critical listener might be able to detect a barely perceptible change in volume when the level is varied as little as 1 db, but only when listening under ideal conditions. Accordingly, if the frequency response of an amplifier is flat within 1 db from 20 to 20,000 cycles, even a critical listener would not be able to detect any difference in the over-all balance of the amplified sounds.

Measurements have shown that the ratio between the loudest and softest passages of music when played by a large orchestra is about 70 db. This is called the dynamic range of music. In actual recording, this range is somewhat compressed. Soft passages are accentuated to overcome the surface noise of records and tapes; loud passages are attenuated to prevent excessive distortion. Still, the range of hi-fi program material is in the neighborhood of 50 or 60 db, and for proper reproduction, an amplifier must have a similar range.

The dynamic range of an amplifier is limited by its inherent hum and noise level, which is

usually specified as so many db below maximum output. If the hum and noise level of an amplifier is stated as being "—50 db," meaning 50 db below maximum power output, and if we adjust the volume so that the strongest musical peaks are reproduced at maximum amplifier power, the very softest passages would be on the same level as the inherent hum and noise. Obviously, the lower the noise level in an amplifier, the better.

Why so Loud? Noise is everywhere—in the street, in an office, even in your own home after everyone is in bed. How much noise? Measurements show that the noise level in a very quiet room is about 40 db above the threshold of hearing. At orchestra hall, the peak sound level during the loudest passages might reach 110 db.

If a recording with a dynamic range of 50 db is reproduced in your living room at full-orchestra level, the softest passages might be reproduced at about 60 db. This is 20 db above the residual noise in a very quiet room.

Now maybe you don't like the idea of having a full orchestra in your living room and you turn down the volume to a maximum level of—say 80 or 90 db. At this level the softest passages are reproduced at only 30 or 40 db, and some of the music might be lost—masked by the ever-present room noise.

Not every musical selection has such soft passages and chances are that you won't miss much by turning down the volume a bit. But you can readily see why hi-fi—real hi-fi—should be played loud.

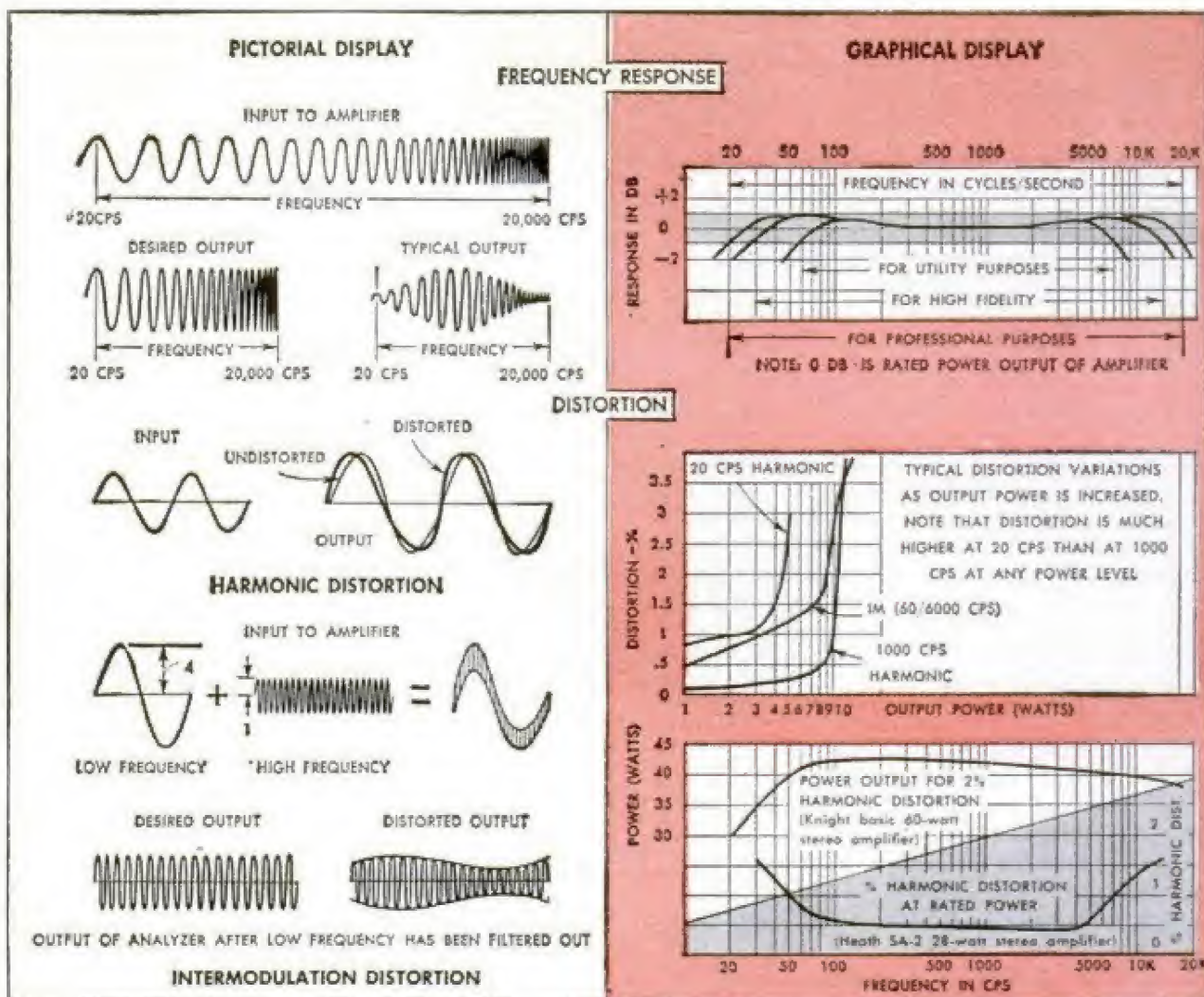


Fig. 1. Factors influencing amplifier quality. Graphs, right, show typical methods of presentation

waste as much as 99% of the applied power. Efficiency, of course, is no indication of speaker quality, but the inefficient units require more driving power and that means a larger, more expensive amplifier.

This, incidentally, is a good argument for selecting your speaker first. Then, if the speaker manufacturer tells you it takes 10 watts to drive the unit to full orchestral level, there's not much point in buying a high-powered amplifier. But if it takes 30 watts—well, you can't send a boy to do a man's job.

As an added consideration, you may want to drive two sets of speakers from the same amplifier so that you'll have music both upstairs and downstairs, or in two different rooms. That will take just twice as much amplifier power, and if you add still more speakers, the required power rises proportionately.

The absolute maximum power an amplifier can deliver depends upon the number and types of output tubes employed. One set of tubes may be able to provide a maximum of 10 watts while a different set may deliver 100 watts or more. Sound quality, however, decreases rapidly as the maximum power output of any amplifier is ap-

proached. That's why the published power output rating never refers to the absolute maximum, but rather to some arbitrary lower level at which, in the opinion of the manufacturer, the deterioration of the sound is not excessive.

But here's the rub. In the absence of any official standard, there can be considerable difference of opinion as to what constitutes excessive deterioration. What's more, there are numerous ways of "gilding the lily" just in the way that the specifications are written, or in their subsequent interpretation. Here's what I mean.

Originally the term power output referred to the continuous *effective* power an amplifier could deliver in response to an applied sinusoidal signal. Lately, the term *peak* power has been appearing with ever-increasing frequency. Now peak power refers to the maximum *instantaneous* power available from the amplifier — and that's just twice as great as the *effective* power. In other words, an amplifier rated at 10 watts continuous effective power will deliver 20 watts of peak power, and that's an important consideration when comparing amplifier specifications.

Even more recently, the term *music*



Fig. 2. Kit-built amplifiers rival factory-built components in appearance and performance, but at much lower cost. Above units include basic power amplifiers, complete integrated amplifiers and preamplifiers

power was developed, and this adds even more confusion. At best, an amplifier rated in terms of music power would be just as good as one rated in terms of continuous effective power. At worst, the former could exhibit overload tendencies which would seriously increase distortion at the rated power level. When judging amplifiers, therefore, it is important to know the type of power referred to in the specifications.

FREQUENCY RESPONSE. It is generally agreed upon that the human ear at its best can hear only those sounds within a frequency range of 20 to 20,000 cycles per second. The actual frequency content of music is probably somewhat narrower but, be that as it may, a good amplifier should be able to treat all audible frequencies alike, without any serious discrimination.

With electronic equipment it is generally easier to amplify frequencies in the mid-audio range than those at the extreme ends of the band. As a result, the response of an amplifier may suffer at the very low and very high frequencies, as shown in Fig. 1.

Fortunately, the human ear is not very critical when it comes to estimating the loudness differences between two sounds. Even a very critical listener can't differentiate between the original recording and the resulting reproduction unless the amplifier response varies by more than 1 db. But for critical evaluation you should know the response of an amplifier at its *maximum rated output power*.

Some frequency response specifications fail to mention the power level at which the measurements were taken. Others may specify a 1-watt level or normal listening level. This is perfectly legitimate, but you can't compare such specs with others specifying the response at full rated power. The reason is that frequency response deteriorates as full power output is approached and this must be taken into consideration in any comparative amplifier evaluation.

HARMONIC DISTORTION. No amplifier is perfect. All of them tend to change or distort the signal and this introduces new frequencies which were not present in the original program.

We've already mentioned that mid-audio frequencies are easier to reproduce than those at the high and low ends, and this applies to distortion as well as frequency response. To say that harmonic distortion is X% has little meaning unless the frequency and power level is also specified. This is shown in the second and third graphs of Fig. 1 which clearly indicate the manner in which the distortion varies in typical amplifiers. A hypothetical amplifier, as represented by the second graph, may have very low harmonic distortion at 1000 cycles, up to a particular power level, but the same unit may distort 20-cycle signals excessively even at low power.

The third graph in Fig. 1 shows the most common methods employed by hi-fi-amplifier manufacturers to give complete data

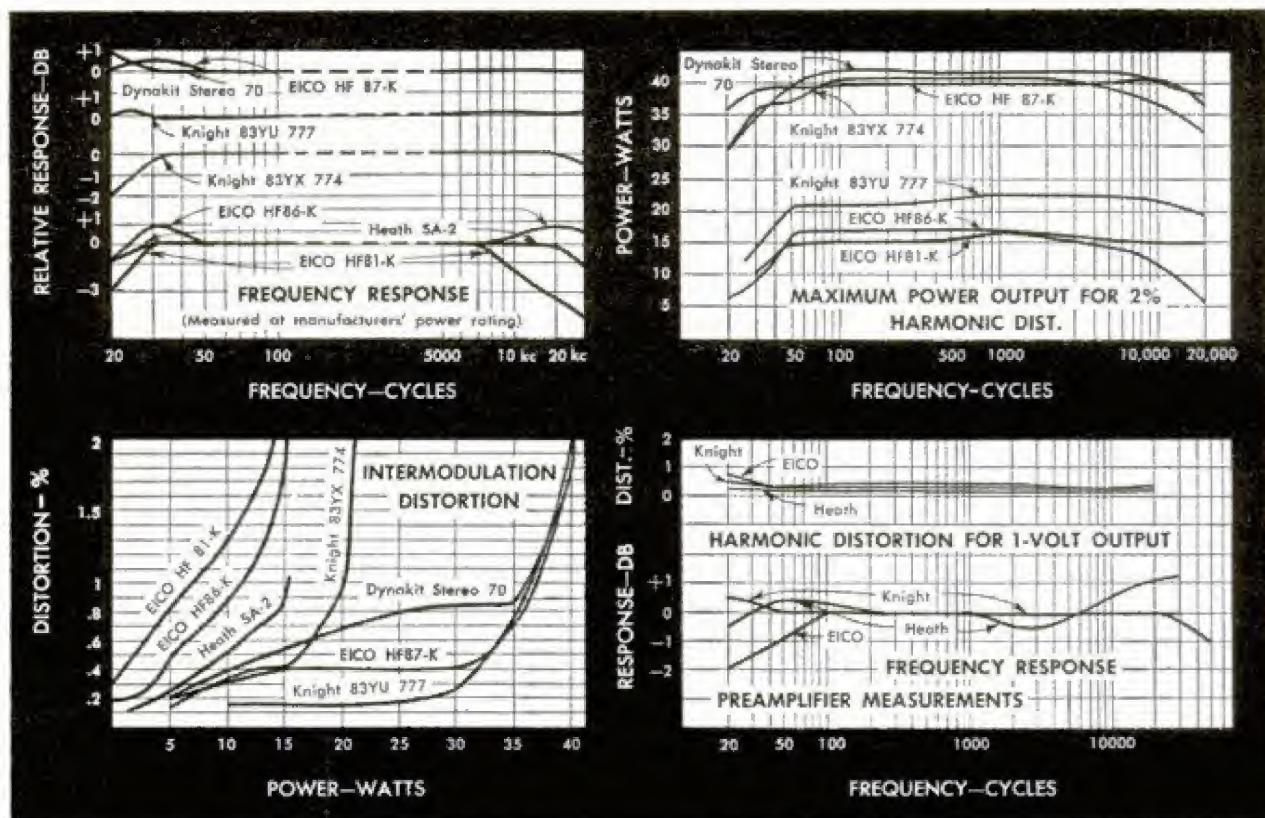


Fig. 3. Measurements on kit-built units closely coincide with manufacturers' published specifications

pertaining to harmonic distortion. The upper curve shows the amount of continuous power available at each frequency without exceeding 2% distortion. This particular amplifier is rated by its manufacturer at 30 watts per channel (60 watts stereo) and the curve shows the conservative nature of this rating. The lower curve shows another way of presenting similar information. In this case the amount of actual distortion at each frequency is plotted at the rated continuous power output of the amplifier. Note how distortion increases at each end of the frequency spectrum, but that it remains well below 2% even at 30 and 15,000 cycles.

INTERMODULATION DISTORTION. This form of distortion results from interaction between tones of different frequencies within the amplifier. It is perhaps the most annoying form of distortion since it gives rise to the production of new frequencies which are harmonically unrelated to those of the original signals.

Like other forms of distortion this interaction between frequencies increases as the power output of the amplifier approaches its maximum limit, as shown in the center graph of Fig. 1. A set of curves such as these, for each amplifier under consideration, would be most valuable in helping you make your final selection.

Seldom will you find all of the pertinent amplifier data given in a catalog or advertisement. Yet, because high-fidelity ampli-

fiers are sold chiefly on the merits of these specifications, full information must be available. My suggestion—make your tentative selection on the basis of rated power output and price, as given in catalogs and advertisements, then write for complete technical data and compare.

If you're starting from scratch, even if you don't expect to invest in a stereo speaker system immediately, you'd be wise to buy a stereo amplifier. And with good reason. The two individual channels of a stereo amplifier can be connected together for monophonic operation, but a single-channel amplifier can't be used for stereo—not without buying another one. And two monophonic units cost far more than a stereo amplifier of similar quality. You'll want stereo eventually, so you may as well prepare for it right from the start.

Amplifier Kits

Not everyone enjoys "rolling his own", but if you do, you can spend a few pleasant evenings building a hi-fi amplifier and save up to 50% in the bargain. Amplifier kits are available in almost as great a variety as factory-built units. They are designed to the same standards and judged by the same specifications. A few kit-built amplifiers are illustrated in Fig. 2 and the actually measured specifications for these and some other kits are given in Fig. 3.

If the ease with which some of these kits

(Continued to page 240)



Falcon's new parabolic reflector gives you greater vision for night driving.

Why does the Falcon have single headlamps and dual horns?

Single headlamps cost less to replace. They're *right* for an economy car. But before Ford engineers would OK them for the Falcon, they had to devise a single-light system that would not sacrifice safety.

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This same foresighted engineering is found in a single, *adjust-it-yourself* carburetor, bolted-on front fenders that cut repair costs, a gas tank accessible from the trunk, and an aluminized muffler that lasts up to twice as long as ordinary types.

Dual horns cost more! But horns almost never need replacement so there's no long-range economy in skimping on the original installation. And dual horns are better. No

single horn gives the quality of sound of two horns. And there's added safety in the warning power of two horns.

That's hidden quality that means *long-range* economy. You'll find it throughout the Falcon. It's there in the sound-conditioned roof, in underbody members that are zinc-coated for protection against rust, in a finish that *never* needs wax, a new battery mount that makes batteries last longer.

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Second, stainless steel has no significant tension loss at engine operating temperature. This is unlike carbon steel oil rings. No tension loss assures proper tension of the side rails of the oil ring against the cylinder walls—even in tapered and out-of-round bores. Again, this proper tension is exerted for the entire life of the ring which means better oil control longer.

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Valves and Valve Parts • Tappets • Water Pumps
SEALED POWER CORPORATION • MUSKEGON, MICH.

PLANETS OF OUR SOLAR SYSTEM

(See page 102)

PLANET	DIST. FROM SUN (MIL. OF MILES.)	LENGTH OF YEAR Relative to Earth	VEL. OF ESCAPE MI/SEC.
Mercury	36.0	88 days	2.2
Venus	67.2	224.7 days	6.3
Earth	93.0	365.25 days	7.0
Mars	141.5	1.886 yr.	3.1
Jupiter	483.3	11.86 yr.	37.0
Saturn	866.1	29.46 yr.	22.0
Uranus	1782.5	84.02 yr.	13.0
Neptune	2793.2	164.79 yrs.	14.0
Pluto	3675.0	248.44 yrs.	6.6

PLANET	RATE OF ROTATION Relative to Earth	MASS Rela- tive to Earth	DEN- SITY grams cc.	DIAM- ETER (Miles)
Mercury	88 days	.04	2.86	3,000
Venus	?	.80	4.86	7,700
Earth	1 day	1.00	5.52	7,900
Mars	24 hrs. 37 min.	.11	3.96	4,200
Jupiter	9 hrs. 55 min.	317.	1.34	86,700
Saturn	10 hrs. 14 min.	95.	.71	71,500
Uranus	10 hrs. 40 min.	14.7	1.27	32,000
Neptune	15 hrs. 40 min.	17.2	1.58	31,000
Pluto	?	.7	5.3	6,500?

PLANET	GRAVITY AT SURFACE	MOONS	DIAMETERS OF MOONS	DISTANCE TO MOONS (Miles)
Mercury	.27	—	—	—
Venus	.85	—	—	—
Earth	1.0	1	2160.0	240,000
Mars	.38	2	105	5,800; 14,600
Jupiter	2.46	12	15 to 3,200	112,600 to 14,800,000
Saturn	1.17	9	300 to 3,550	115,000 to 8,034,000
Uranus	.92	5	150 to 1,000	80,000 to 334,000
Neptune	1.12	2	3000; 200	220,000 to 5,000,000
Pluto	.9	—	—	—

(Reprinted from Dr. Dan Q. Posin's book, *Out of This World*, published by Popular Mechanics Press.)

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SUPREME VERSAMATIC



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Div. of A • S • R Products Corp.

Selecting Your Amplifier

(Continued from page 236)

meet the Heath-proposed standards intimates that these standards are low, let me assure you that this is not true. It takes high quality parts and careful attention to circuitry to obtain appreciable undistorted power at the extremes of the audio-frequency range. The fact that the results shown were obtained without any effort towards optimizing the performance is a tribute to kit-manufacturers' integrity in rating their components.

Two Units or One?

Every amplifier consists of two basic parts: A preamplifier and a basic power amplifier. Some of them have both of these parts mounted on the same chassis; with others, you buy and install the two units separately. The preamplifier furnishes all of the operating controls, while the power amplifier just sits there and converts the signal from the preamplifier into power for driving the speaker.

The separate-chassis units are more flexible—often provide more control functions—but they're not necessarily better. Their main advantage is that they permit the heat-producing power amplifier to be mounted separately, in some well-ventilated location, while the cool-running preamplifier can be installed with other components in a more restricted space. This is particularly important with amplifiers which must deliver a great deal of power and most units rated in excess of 40 watts are of the two-chassis variety.

Flexibility Prevents Obsolescence

Electrical specifications aren't the only things you must consider when selecting your personalized stereo-fidelity amplifier. There's also versatility — both of control functions and of eventual applications. The modern stereo amplifier is not the simple device of its outdated counterparts. It's a complicated maze of controls and switches needed to handle the conflicting requirements of the various program sources, and for proper adjustment of the resulting sound to virtually duplicate that of the original orchestra. Some of these controls are used so seldom that their inclusion seems hardly worthwhile; others are an indispensable part of high fidelity and stereo. To ascertain that the amplifier you buy has all of the desired controls, you should become familiar with their functions and how they affect overall quality and flexibility.

Input Jacks. Every amplifier should have enough input jacks to handle a variety of

(Continued to page 284)

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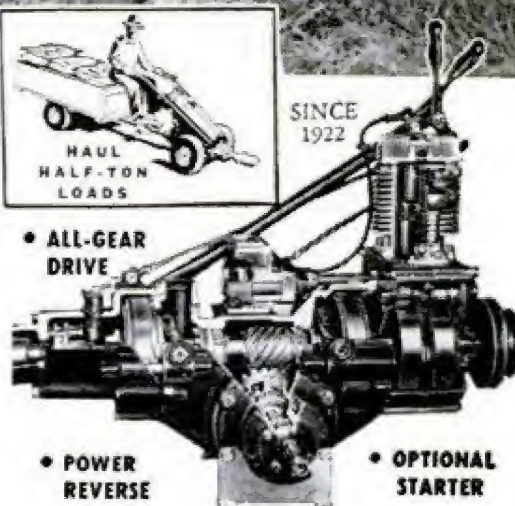
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Write for Catalog of Complete Line of Pliers

CHAMPION DEARMENT TOOL COMPANY

Meadville 1, Pennsylvania

Should We Let Nature Take Its Course?

(Continued from page 111)



U.S. Department of Agriculture photo

By destroying thousands of acres of Klamath weed, the imported Klamath weed beetle became a hero

wide and to contain $2\frac{1}{4}$ billion birds! But even a prodigious slaughter program—for food, for sport, even for fertilizer—could not make any very real inroads on such a population. The passenger pigeon died off when the forest, his natural habitat, was cut to make way for farms.

Almost anything can upset nature's precarious balance—even engineering projects. Construction of the Welland Canal, which by-passes Niagara Falls, opened the way for a disaster of costly proportions. The lamprey, a rasp-toothed, eel-like fish—"the Dracula of the Great Lakes"—slipped in from the sea, leaving natural enemies behind. On a wholesale scale, it started attaching itself to food fish, sucking them dry of blood. The market catch of trout and whitefish in Lakes Huron and Michigan stood at \$8 million a year in pre-lamprey days. It fell to zero. There was similar devastation in other lakes.

The research program, now nearing completion, has developed a poison lethal to the lamprey larva but harmless to food fish. Once it has done its work, gigantic restocking operations will get under way.

There are dozens of examples of man's tinkering with nature's balance to his own great cost. Historically, one of the greatest examples of this occurred early this century when well-meaning conservationists decided to make Arizona's Kaibab Forest a deer refuge. To provide ideal conditions, deer enemies—wolves, mountain lions and coyotes—were destroyed. Hunting was banned. From all outward appearances, a

(Continued to page 266)



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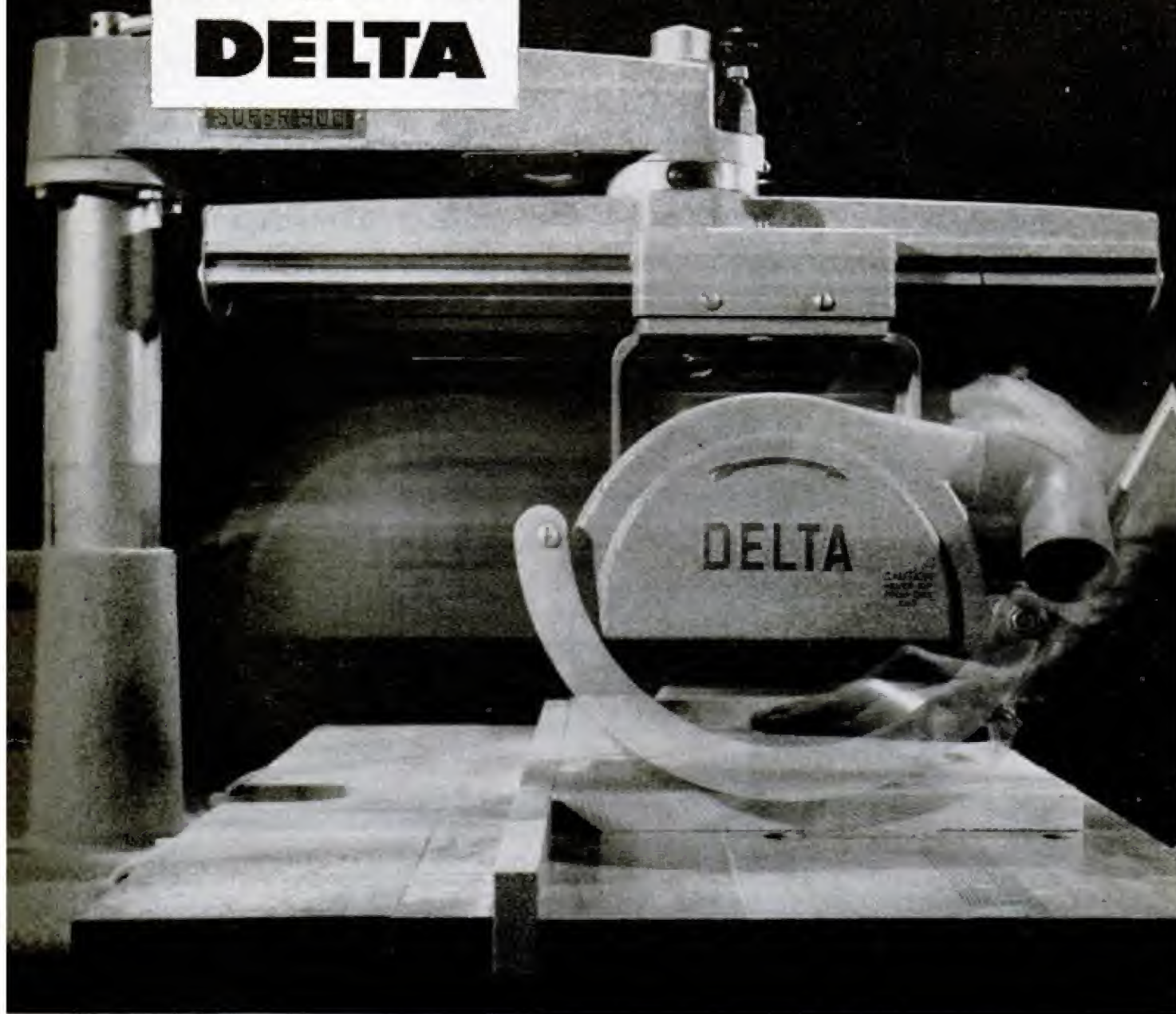
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CUTTING MOULDINGS such as this extra large cove moulding is easily done with the regular blade. By simply adding the moulding cutter-head you can cut an endless variety of shapes.



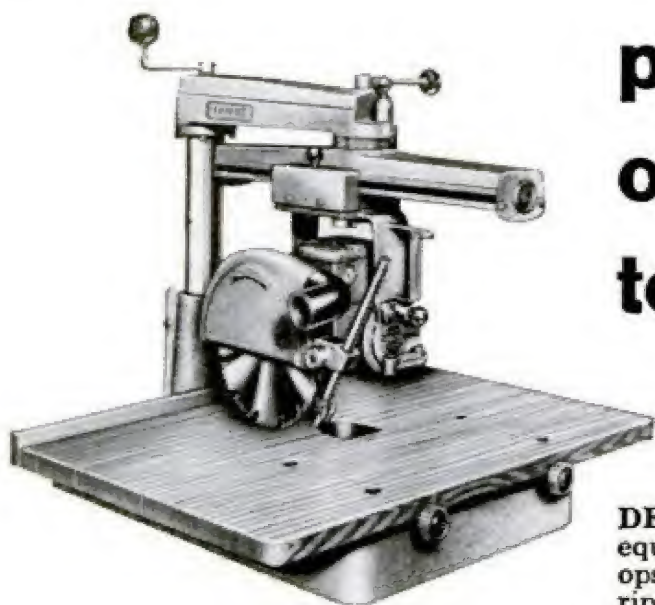
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"Super 900" Radial Saw



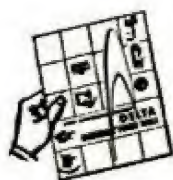
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DELTA "SUPER 900" RADIAL SAW—
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Here's a workshop workhorse that tackles the toughest jobs you've got—and delivers perfection every time! This rugged Delta Radial gives you precision that is actually built in, yet is easy to use right from the start. You get all the flexibility that Delta "Turret Arm" action provides. Swing, spin or tilt the head—you'll do dozens of operations conveniently, safely because the cutting tool stays over the table throughout a 360° swivel. With this machine you never have to worry about alignment. Thanks to Delta's exclusive, new "Micro-Set" Miter Stops, you can be sure of perfect 90°

and 45° cuts for the *life of the machine*.

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See the world's most complete line of home workshop power tools and accessories—pictured and described in this colorful, FREE Homecraft catalog. Write to: Rockwell Manufacturing Company, Delta Power Tool Division, 502C N. Lexington Ave., Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Co. of Canada, Ltd., Guelph, Ont.



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World's Largest Manufacturer of Shears, Scissors, Pinking Shears, Skalloping Shears, Metal Cutting Snips and Garden Shears

PM Houseboat

(Continued from page 203)

door to hold it up out of the way. You'll notice in studying Fig. 52 and section B-B that the clearance at the top of the door is covered on the outside by a strip fastened to the cabin front. Similar strips are attached to the face side of the door opening along the two sides. The door itself is a panel of $\frac{3}{4}$ -in. plywood cut to fit the opening. The opening for the glass in the door itself can be rabbeted if you have the tools. If not, the plastic can be held with rabbeted strips screwed to the inside. Protective grilles, consisting of brass rods held in mahogany cleats, are placed over the lower windows behind the foredeck seats. The after cabin door has no glass, and is hinged on the starboard side of the opening with a long piano hinge. Both doors should be fitted with locks.

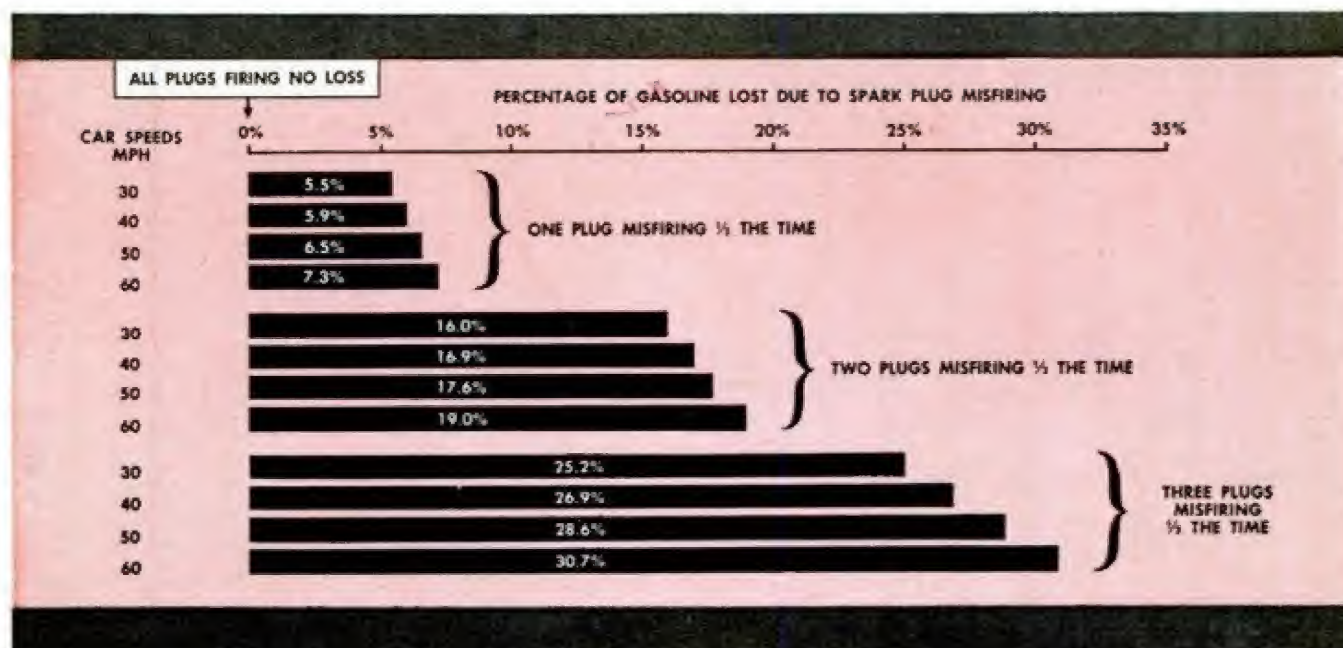
The one cutaway drawing in Fig. 54 shows the entire galley at a glance, which is built in place just aft of the port locker. The galley offers complete cooking and food-preparation facilities; including a two-burner alcohol stove, a roomy 100-lb. ice box, a sink with running water and storage space galore in cabinets and shelves. All counter surfaces are covered with plastic laminate. You will notice that both the stove and sink recesses are provided with covers to form an unbroken work area, the tops of the covers being faced with matching plastic laminate. The sink cover is merely a lift-out panel, whereas the cover over the stove recess is a folding affair that stands upright when open. The insulated ice box is a custom-made item which a local tinshop can provide. While the width of the aisle doesn't permit the door of the box to open fully, it will open sufficiently wide to provide convenient access. Of course, if you prefer, the ice box can be fitted with two doors. Before you start installing the galley, the port side of the cabin should be fitted with a plywood wall below the coaming member, keeping in mind that an opening should be left for attaching the ice-box drain hose, Fig. 53, as well as the sink hose, to through-the-hull fittings. All doors, trim, stove-recess front are mahogany. In studying Fig. 54, you will see how the counter top is supported at the rear edge by a $\frac{3}{4}$ -in. member which rests on top of the coaming member. Shoe molding is put down around the base of all cabinets after the floor is covered with linoleum. The lift-out bilge covers in the floor, Fig. 42, are strips of flat, chrome steel screwed to the edges of the panels so they overhang all around and form a lip.

(To be concluded next month)

Look how much you lose when Spark Plugs misfire!

All spark plugs tend to misfire intermittently as they wear, and modern high horsepower engines make it difficult to tell when such misfiring occurs. But as the chart below shows, spark plugs that fire only part of the time waste gas by the gallon. For example, if your

car gets 16 miles per gallon at 60 miles per hour, one misfiring spark plug can drop your mileage 7.3% to 14.8 — two can drop it 19% to 30.7% — three can drop it to 30.7% to less than 12. You lose mileage at all speeds, and the higher the speed, the greater the loss.



To get the best mileage from your car, replace your spark plugs at least every 10,000 miles with new ACs. AC Fire-Ring Spark Plugs will pay for themselves through the improved mileage you'll get. ACs have such mileage-producing features as exclusive leakproof Conductaseal center electrode bond for uniform heat range, and superior Buttress Top insulator for greatest resistance to electrical flashover leakage. These plus many other advancements have kept AC in the forefront of spark plug development for 51 years. See your dealer, ask for ACs — and save.

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Offshore Cruising by Outboard

(Continued from page 165)

them came in with their catch. Local processors buy them, after which the shrimp are cleaned and packed in ice for shipment to market. For 50 cents we got all the fresh shrimp we could eat for the next few days. Watching the unloading of live turtles at Key West was equally interesting; the live turtles, some of them weighing 500 pounds, are kept in pens built in the water, where they remain until butchered.

In many areas the Intracoastal Waterway is the offshore sailor's only means of reaching the open ocean, since roads to launching sites do not extend to the coast. This great waterway, like most land highways, has conveniently spaced fuel and servicing stops, making it possible to cruise as far as time and money will permit. Since fuel and water tankage is limited on a small cruiser, it is wise to plan your stops before shoving off from home port or launching site for a cruise through strange waters.

For a list of waterfront service stations and free charts of the area you expect to cruise, write Texaco Waterways Service, 135 E. 42 St., New York 17. While these charts are not intended to be used for navigation, they give fairly accurate layout of the Intracoastal Waterway and adjacent waters with location and description of navigation lights and radio beacons, tide tables and other valuable information. Use only official government-published charts for plotting courses and navigation. Other publications that give helpful information include the *Coast Pilots*, *Inland Waterway Guides*, *Cruising Guide to the Bahamas* and books authored by small-boat skippers who have cruised your area.

Be sure to have all publications covering your cruising area on board. Study them beforehand and memorize important landmarks and coastal features to make navigation easier at nighttime, or in an emergency when there is little time for close study of charts and references. Remember, there are no convenient filling stations where you can stop for service or directions—you're on your own offshore.

Turning to the cruising possibilities on the Pacific coast, you can trail an outboard cruiser to the Bay of California for tropical cruising on Mexican waters, or launch directly into the Pacific at numerous places along the coasts of California, Oregon and Washington.

Offshore cruising is at its best in the Puget Sound area where, with sufficient fuel supply, one could sail in sheltered waters almost the entire distance to

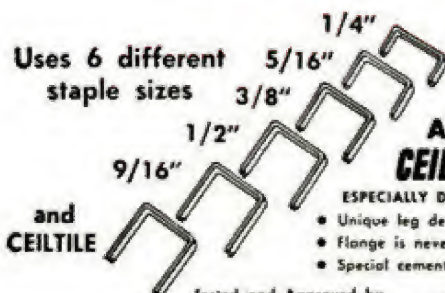
(Continued to page 250)

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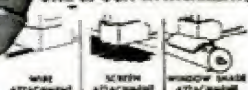
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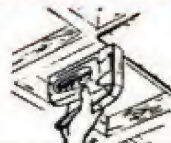
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Alaska. Thousands of islands off the coasts of Washington and British Columbia make the area ideal for cruising. Other good offshore spots include the San Francisco Bay area, the Santa Cruz Islands 10 miles off Santa Barbara, and the Santa Catalina Islands 18 miles off Long Beach.

A good boat for offshore cruising is one that will not pound excessively when heading into choppy water at moderate speeds. The hull design of such a boat is a compromise between a deep-draft vessel and a planing type, resulting in some loss of speed but gaining in stability; a deep-draft vessel automatically has a lower center of gravity than one of shallow draft. To avoid pounding and have an easy ride, buy a boat that has a well developed V-bottom which has a fairly sharp entrance at the bow.

Construction of an offshore boat must be first class, using good materials and somewhat heavier frames and planking than one might find in a boat designed for use on rivers and small inland lakes. Modern materials and construction methods make it possible to produce boats that are comparatively lightweight, dry, roomy and much easier to maintain than older boats. Check the method used for fastening the transom into the hull since it is possible for powerful outboards to crack the transom or even tear it out with the twisting action produced by propeller thrust. All outboard transoms should have ample bracing which in wooden and plastic boats takes the form of knees or braces fastened to the transom and longitudinal members. Metal-hulled boats also must have adequate bracing at the transom. Such bracing should either be welded or riveted to the hull or longitudinal members—never spot welded.

The bow of a vessel that is subjected to hard treatment by slamming into rough seas can be another source of trouble. Planking that is poorly attached to the stem has been known to split wide open when the going is rough. Don't let this happen to you. Also, check the boat of your choice to see that frames are not spaced too far apart and that proper fastenings have been used in sufficient quantity.

Glass-fiber hulls should have extra layers of cloth laminated in the stem area of the bow, keel, chines, transom joints and other stress areas. This, in addition to reinforcing material like marine plywood, wooden strips, or preformed glass fiber laminated to the hull bottom and chines on the inside, serves as stiffening material. Without it, the hull will give below-standard performance. Metal hulls should be reinforced in a similar manner.

A dry boat is a happy boat! In this
(Continued to page 252)

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respect, be sure that windows, hatches and ventilators are watertight when closed.

Deck hardware should be located in the proper place, heavy enough to handle line and tackle of the size required for the boat, and fastened properly. The latter means that cleats, bitts and chocks are through-bolted (bolts must pass through the hull or deck) to a framing member or block on the inside face of the planking. Be sure that all fastenings and hardware are of good quality bronze or stainless steel. This is a must since you will be relying on them to hold an anchor in a blow, to secure dock lines, possibly tow a disabled vessel, tow skiers and many other functions. Poor fittings can cause accidents and ruin an otherwise enjoyable cruise. Chromium or brass-plated steel fittings are no good on an offshore cruiser. When drenched with sea water, they become unserviceable overnight. Our cruiser had a chromium-plated brass cap on a steel fill pipe of the water tank that became so frozen with rust that we had to free it with wrenches. A thick coating of heavy grease kept the threads from corroding during the cruise.

If you are in doubt about the safety requirements as applied to a boat you own or plan to buy, ask a member of the Coast Guard Auxiliary to check it over. He will be glad to do it and will tell you what changes or additions may be necessary before the boat will pass the regular "Courtesy Examination." Important here are proper venting of spaces housing gasoline tanks and provision for proper fuel-tank vents, so that highly explosive gasoline vapors do not collect inside the boat. The *Sea Joy* required some venting changes but a prelaunching inspection by a helpful Miami Coast Guard Auxiliary captain made it possible to make the changes while the boat was still out of the water. Such foresight can mean the difference between departing on schedule or being delayed several days in port.

Be sure the running lights are correct and that they are located according to regulations. Since we had expected to cruise in international water on *Sea Joy*, it was necessary to change the white running lights so that the one amidships showed a 20-point beam forward and the one on the after part of the vessel showed a 10-point beam aft. This was accomplished easily by removing the lens of each light and applying a mask formed from strips of plastic tape to block out the unwanted sector of the lights. Removable masks sold for this purpose are available for some lights.

To be absolutely sure your boat will remain afloat in the event of a collision, it

should be provided with sufficient flotation material. Most manufactured boats are provided with some type of flotation, usually foamed plastic but sometimes only sealed air spaces. The latter now are considered a poor second choice because of the possibility of rupturing the enclosures in a collision.

An enclosed cabin is just about a must for offshore cruising for maximum safety, comfort and to permit locking up valuable equipment when the boat is left unattended. A semi-enclosed cabin cruiser provides some of the safety features of a fully-enclosed model, but is a poor second choice for comfort and seaworthiness in really rough seas. Large cresting waves can throw many gallons of water into such a boat, swamping it in short order. While running offshore from Marathon to Key West, there were a number of times when the bow caught such waves, taking streams of solid water over the foredeck and cabin top. With all windows and hatches closed, not one drop stayed on board, and we were completely dry below. A high windshield on the flying bridge further prevented the water from running into the cockpit.

The convertible top was a most welcome piece of equipment. It not only protected us from rain and spray but also kept the crew cool and comfortable, especially when anchored or at dockside. To comply with the daily "operation suntan," the top was folded out of the way quickly by releasing the two stern shrouds.

An enclosed cabin also permits installation of an enclosed head (most desirable if you have guests on board), an adequate, permanent galley, ice box, and comfortable sleeping quarters for at least four. With screens on the windows, insects won't disturb pleasant dreams or get in the soup.

On most small cruisers, the enclosed head doubles as a hanging locker, which was the case on *Sea Joy*. Our shore clothes were kept in a zippered plastic clothes bag, which was hung on a hook bolted on the forward bulkhead. Here they were kept out of the way, yet dry and wrinkle-free, for the entire cruise.

The head also served as radio room on the *Sea Joy*, the Heathkit radio-direction finder being mounted on a bracket attached to the forward bulkhead.

The lack of a built-in ice box or refrigerator on a boat is not a serious fault. We used a large aluminum ice chest. When having a beach party, the ice chest was simply lowered into the dinghy and rowed ashore. At home the ice chest does duty as the cold pantry for picnics, camp-outs and other outings.

(Continued to page 254)



WHAT A DIFFERENCE TWO CYLINDERS MAKE! THAT'S WHY YOU'LL LOVE THAT LARK V-8

In the field of domestic engines, two more cylinders make the difference between adequate transportation and spirited performance ➤ And sometimes performance is fun, particularly when the price is just a little more than the "6" ➤ The Lark V-8 in standard form pulls 180 hp at 4500 rpm and 260 ft. lb. of torque at 2800 rpm. With optional 4-barrel carburetor and dual exhausts, you get 195 hp at 4500 and 265 ft. lb. at 3000 so that drivers can turn zero to sixty in just over nine seconds ➤ Economical, too! In last year's Mobilgas Run, The Lark V-8 with automatic transmission topped all other eights ➤ The Lark V-8 is rugged. It runs on five massive main bearings and (here's the hooker), piston travel per mile in high gear (3.31 rear) is only 1380 feet. Engine revs per mile in high gear is an easy 2550 ➤ See your Studebaker Dealer and try The Lark V-8. You'll love it!

LOVE THAT **LARK** ² BY STUDEBAKER

Getting a good night's sleep is a must if you are to enjoy a busy cruising schedule the next day. If you are accustomed to sleeping on a soft mattress 365 nights of the year, sleep will not be comfortable or easy to come by on hard seat cushions that double as bunk mattresses. On board a small cruiser there isn't room for cabin seat cushions and also sleeping mattresses. Therefore, if the hard cushions are optional on the cruiser you intend to buy, leave them off and buy or make up your own from foam rubber or urethane foam. They should be a minimum of two inches thick. Being of cellular structure, such foamed material is buoyant, so that it can be used for emergency life-saving equipment, too.

Nights usually are quite cool on the water; therefore it's wise to take along an ample supply of warm blankets. Even though daytime temperatures in the Florida Keys were frequently over 90 degrees, we had all available covers on by morning.

For outboard power on an offshore cruiser it is advisable to have twin motors. Although two 25-horsepower motors will cost considerably more than one 50-horsepower motor, the added safety of having a spare that is operational more than justifies the greater expenditure. We used two Mark 78 Mercuries with fine results. If you're interested in economy of operation,

don't buy motors that must be run at top speed to move the boat at its designed cruising speed. Get the next largest size, so that they can be run at about three-quarters throttle, which will save on fuel and engine wear. If only a single motor is used, a smaller spare should be carried for emergencies. Since most small inboard-powered cruisers have only one engine, it is wise to carry a small outboard on board for emergency use, with a demountable or fixed mounting bracket for it on the transom. Remember that it can get awfully lonesome out of sight of land in a boat that is without power.

A good power plant that is installed and serviced properly is of little avail if you run out of gas just over the horizon from the last fuel stop. To avoid this annoyance, two things must be done. First, adequate fuel tankage must be provided. Tanks should be of the permanent type, such as the 18-gallon Tempo tanks installed on *Sea Joy*. With the 35-gallon stern tank built into the boat, this gave us 71 gallons capacity, plus a six-gallon remote tank for emergencies and for the small motor.

The next step, after assuring an adequate fuel supply, is to know the hourly fuel consumption of your motors. This is too important to accept the word of a previous

(Continued to page 257)



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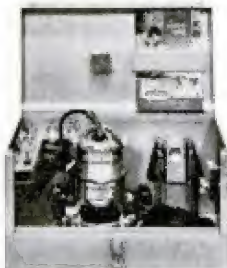
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owner or dealer. Instead, run fuel consumption checks when you are in familiar waters, keeping an accurate log of hourly consumption of gas at cruising speed. If your rig is not equipped with a tachometer, note the miles traveled as per charted course. After checking fuel consumption at cruising speed, do the same for top speed and a slow speed. Then you can figure easily the amount of fuel that will be needed on any run. Record this data in the log book so that you will not have to trust to memory. When checked annually, such fuel-consumption information also indicates the condition of the motors.

Shiny new motors are a temptation to thieves. To assure keeping the motors for the entire cruise, it's a good idea to install a locking device on the transom. When locked in place, the motors also can't be lost overboard. Carry a spare propeller, spare spark plugs and necessary tools to do minor servicing. Check all control linkages and fastenings carefully each day before shoving off.

While ancient Polynesian seamen navigated their boats with remarkable accuracy without the aid of a compass, modern spare-time boaters will be better off with a good marine compass. This is one piece of navigational equipment that is absolutely necessary on all boats that are to be sailed out of sight of land.

All coastal waters of the United States, its territories and possessions have been charted. Copies of these charts are available from the Coast and Geodetic Survey, Commerce Dept., Washington 25, D.C., and at authorized sales agents. To find the sales agent nearest you, write to the above address, requesting a list of *Publications Relating to Nautical Charts*. Be sure to specify the general area or areas for which you want a list.

Charts contain a wealth of information about the area. A good coastwise navigator must first study the general use of charts and then study in detail the charts that are to be used. Free courses in piloting, seamanship, navigating, engine maintenance and other subjects are given by more than 200 local squadrons of the United States Power Squadrons, a civilian organization dedicated to promoting safe boating. Similar instruction may be obtained from your nearby Coast Guard Auxiliary Flotilla. In my opinion, every prospective boat owner should take at least the basic piloting and seamanship course before taking a boat out for the first time. The lessons learned in these classes can save your life.

Electronic navigation and communica-

(Continued to page 258)

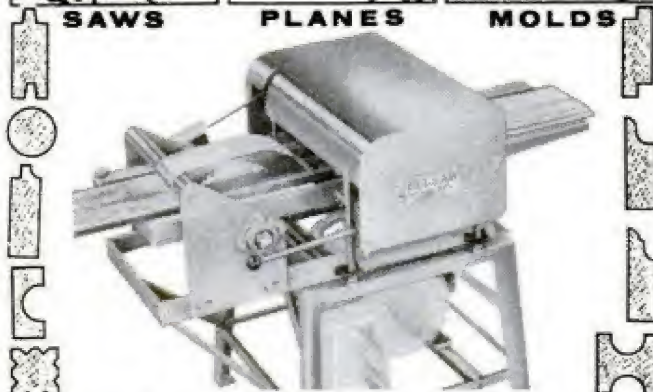
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tions devices, until recently limited to large ships and luxury yachts because of high cost and bulk, are now manufactured to meet the demands of the small-boat market. Volume sales have kept unit prices down, and use of transistors has reduced the size of the units and their power requirements.

One of the most helpful devices for the small-boat skipper is the radio direction finder. The RDF on the *Sea Joy* was assembled from a kit a week before we left on the cruise. The unit was quite accurate and cost about half the price of a comparable assembled RDF. In addition to functioning as an RDF, the unit also has a standard broadcast band that permitted us to have news and music.

With an RDF on board you can take compass bearings of radiobeacons on shore and obtain a navigational fix, locating your boat at sea. Complete operating instructions are included with each unit.

For safety reasons a radiotelephone (two-way radio) is almost a must on a cruiser that is to be used for offshore trips. The device also provides the convenience of allowing you to talk to persons anywhere on shore via the Bell System and other cooperating telephone companies. Most current models are partially transistorized to reduce battery drain and physical size of the unit. The 30-watt, five-channel Raytheon unit installed on the *Sea Joy* took up no usable space, was simple to install and easy to use. A radio-equipped outboard can call the U.S. Coast Guard for help, if necessary, on the international "Calling and Distress" frequency of 2182 kilocycles. Just knowing you can call the Coast Guard for help if it is needed will add a lot to your boating pleasure.

Radar and depth-sounder units are less essential on small boats, although they are worth considering if you do your boating in areas of high fog incidence.

The cautious skipper in a well-made and well-equipped boat can have the time of his life cruising the salt water. Nothing can beat it for a real boating vacation. ★ ★ ★

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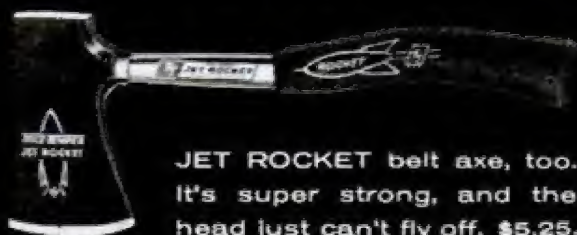
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This Company Loves Tough Problems

(Continued from page 140)



Tiny cryotrons were applied by ADL as switches, making a small-sized, but effective, computer possible

Little solved his personal problem—unemployment—by hiring out to study other men's problems. He and his first partner, Roger Griffin, found it hard going to put the above precepts to test. The first year they earned only \$600, largely by analyzing samples of sugar. Industry looked upon these new "researchers" skeptically; and even among the ranks of pure scientists they were considered oddballs, for the accepted theory was that industry and science could never marry. Some 25 years later, when the steady growth of his company had long since confounded his critics, he expressed the battle this way: "We have been fighting such expressions as 'What's the use?' 'It isn't done.' 'It isn't practical,' and all the other wretched substitutes for hard, earnest, straight thinking."

To prove the futility of negative thinking, Little, in 1921, performed one of his most graphic experiments. Exasperated at hearing industrialists ignore their problems because, as they said, "You can't make a silk purse out of a sow's ear," he decided to disprove the proverb itself. He found that mulberry leaves chewed by silkworms were transformed by a tiny gland at the back of the worm's head into a sticky fluid that was ejected through two microscopic ducts in front, coagulating to form a strong filament of silk. Little then experimented until he obtained a glue-like fluid from cooked sow's ears. This was filtered, boiled and treated with acetone, then placed in a small ejection pump with holes $\frac{1}{1000}$ of an inch in diameter. When forced through the holes, the liquid formed silk-like threads, which were woven into soft, pliable cloth. This material, dyed red and blue, was made into a "silk" purse. It is still on display in the ADL museum.

(Continued to page 262)

"WALKING" SUSPENSION

One of the most intriguing—and rewarding—features of Chevrolet's revolutionary Corvair is its superbly smooth, supple ride. The reason for it lies in a suspension system unique among U.S.-built compact cars: independent suspension at all four wheels.

Here's how it works: each wheel on a Corvair rests on its own deep coil spring, which absorbs road shocks independently of the other wheels. Say, for example, that you're cruising along a choppy dirt road and your left rear tire suddenly sinks into a rut. In any other U.S. compact car, the *right* rear wheel would react as violently as the left to that jolt—which is only natural, since both rear wheels are locked together on a single axle. But in a Corvair, the wheels are divorced from each other, so you virtually "walk" over the ruts.

This "walking" suspension helps keep your Corvair glued firmly on the pavement for extra traction and control on slippery roads. What's more, those resilient coil springs won't squeak,

which means a quieter ride. And Corvair's independent suspension cushions the car's overall weight for a soft, comfortable way of going.

This 4-wheel independent suspension is, of course, a tremendously important advance in the design of compact cars. A five-minute turn at the wheel will show you just how important. The man to see is your Chevrolet dealer—and there's no better time than now. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Technically speaking, Corvair is probably the most fascinating car to come down the U.S. pike in the past 49 years. Here are some of the engineering advances you'll find: an air-cooled "pancake" six engine, mounted in the rear . . . unit construction . . . an amazing unit combining engine and transmission in one compact package.

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Little died in 1935, but the company still practices the same positive approach and each creative staff member (most are from 27 to 37 years old) is encouraged to go his own way in seeking answers. There are few titles, no protocol regarding rank and hardly a closed door anywhere along the office corridors. Men and women (there are a good many women on the staff) are constantly stopping in hallways to discuss projects, even ones they have no connection with. They have the prerogative of going or phoning anywhere. The fact that they exercise this right is shown in these statistics! Although ADL has only 1200 employees, its telephone bill is third largest in Boston and its air travel bill 10th largest in the United States.

These costs, however, represent money well spent. ADL, with a gross of about \$14,000,000 a year, operates for profit, and is one of the few research organizations of its size which does so. Most others are nonprofit groups.

"We are not do-gooders," declared president Stevens recently. "We are quite willing to reform the world, but we insist on being realistic about everything we do. We are a profit-making organization."

This direct, blunt approach is one reason why ADL has accomplished wonders in developing the economies of debt-ridden nations which have asked for advice. Any country that has to squeeze dollars from its budget to pay for a plan is much more likely to use that plan than if it were a free handout from the U. S. government. Puerto Rico is a good example. Several years ago, it hired ADL to prescribe a cure for its economic ills. ADL representatives studied labor potential and resources and helped develop some 500 new productive enterprises, stimulating 36,000 new jobs and a \$46,000,000 payroll. In Honduras, ADL has shown the government that by putting lime onto the clay of rutted, impassable roads, they can be given a smoother and harder surface. In the Philippines, the firm provided professional guidance in developing cooperatives for small farmers. Its staff members have provided equally dynamic solutions for the problems of other countries as well.

A single development in one field, ADL has found, can sometimes lead to a dozen more in widely divergent fields. During World War II, the firm developed an odor-neutralizing solution so U. S. espionage agents behind enemy lines could escape sharp-nosed bloodhounds. From this developed a new set of formulas for doing away with unwanted smells, including a remedy for a dejected manufacturer of

(Continued to page 264)

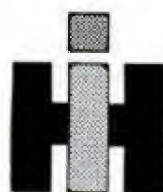
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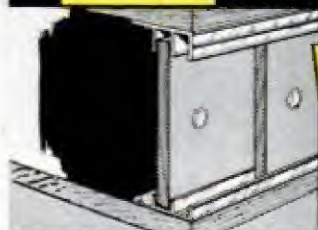
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leather coats whose product was repelling customers because room temperatures brought out its latent animal odors. Another example is the development of chlorella, a one-celled green plant of the seaweed family. It can be grown without soil, in water to which small amounts of chemicals have been added. When dried it forms a light powder with the odor of fresh pumpkins and can be used for animal fodder. ADL started out merely to learn how to increase the output per square foot of water. But staff members could not resist curiosity about chlorella. One scientist wondered whether it had significance as a human food base, especially for nations with little arable land. Another member found chlorella has possibilities as a new source of engine fuel.

But of all the wonders ADL has helped accomplish in the past none will probably compare with what is yet to come. This is evident in the areas being explored by Lt. Gen. James M. Gavin, former Chief of Research and Development for the U.S. Army, who joined ADL in 1958 after an explosive retirement from the service at the age of 51. He came to the firm because of what he refers to as the "regenerative" atmosphere, "the feeling of receptivity to new ideas, of willingness, and communication of thoughts and facts, of hunting and searching."

Currently, Gavin is still interested in the missile field—but not so much for military use as for peace-time applications. As he explains it, there are at least three examples of such applications: (1) Chemical developments in the missile industry which point towards a new family of plastics; (2) The application of the principle that guides ground-to-air missiles to targets to a new surveying technique; (3) Harnessing the powerful missile flame to "jet drilling," a new way of extracting ore.

General Gavin still packs his military wallop, however, and launches attacks at lethargy and smugness wherever he encounters them. "This is a decade of decision," he says. "There will be those who would say that with a higher gross national product, the superiority of the West is assured. This is at best very misleading and at worst, critically dangerous . . . Only industry, imagination, a sense of dedication on the part of each of us, can prevail in this contest."

It looks as though General Gavin, like his ADL colleagues, was taken into the company as a vigorous exponent of the same rugged principles that led Arthur Dehon Little to prove that he could make a silk purse out of a sow's ear any day of the week. ★ ★ ★

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All this, oddly enough, takes place underwater as part of a new technique that one researcher—Adolf Kastelowitz, director of manufacturing research for Republic Aviation Corp.—says has brought precision to the shaping of lightweight metal.

Small sheets of metal 1/16-inch thick already have been shaped experimentally in the laboratory. Researchers now are working on a more powerful version of the electrical metal-shaping device for heavier metal operations.

By charging storage condensers to 20,000 volts, then discharging this power between two underwater electrodes, they make a spark that generates a powerful shock wave in the water. The shock wave blasts the metal into the shape of the die upon which it rests.

Kastelowitz says the system promises to be useful in working some newer steel and titanium alloys that require heavy, complicated equipment to achieve the necessary close tolerances and aerodynamic smoothness.

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U.S. Fish & Wildlife Service photo

Banded ducks are placed in box to be fluoroscoped for the detection of lead pellets in the flesh or crop

deer paradise was in prospect. Actually, disaster lay ahead.

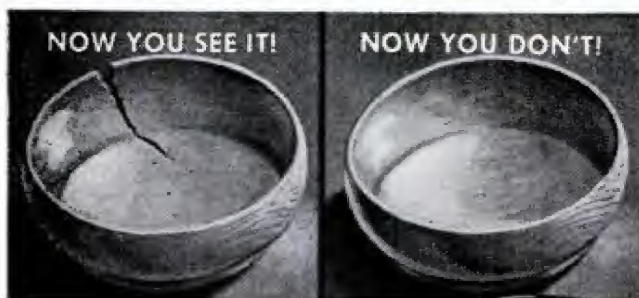
With no enemies to hold them in check, the deer population skyrocketed from an initial 4000 to 100,000. Since canyons and semidesert hedged the forest, the animals couldn't move elsewhere. When food supplies were exhausted, starvation took over and 60,000 animals died in the 1924-25 period. Meanwhile, severe damage had been dealt the forest. It could no longer support even the small initial deer population. Thus, in the final analysis, apparent enemies were in reality the best friends of the deer; life depended on these enemies.

One more historical example of what can happen. In 1869, a Medford, Mass., scientist unwittingly opened a Pandora's box. He imported gypsy moths from Europe, hoping to cross them with silkworms to produce a hardy breed on which a U.S. silk industry might be based. In Europe the gypsy moth is no great problem; it has enough natural enemies to keep it in check. But when it came to the U.S., these enemies were left behind. Result: It bred prolifically and attacked forests to do damage high in the millions of dollars.

A similar situation arose in Australia and New Zealand. Last century, rabbits were imported for sporting purposes. With natural enemies left behind and other conditions ideal, rabbits increased at an explo-

(Continued to page 268)

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America's finest tractor. Ruggedly built. Easy to operate. 790 lbs. Borg-Warner clutch, trans. and diff 140 to 1 reduction. 40% more drawbar pull than ordinary tractors 8-1/4 H. P. engine. 20 quick change implements. HOOD, FENDERS.

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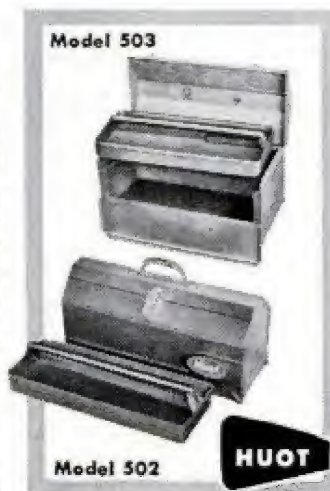
NO NAILS NO SCREWS NO BOLTS
Now a sawhorse in a jiffy! Just use Jiffy Brackets and 2x4s. Sold by hdw. and bldg. supply stores everywhere, or order direct. \$1.95 A pair. *Higher W. Coast*

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Grand Haven, Mich.

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You owe your tools a HUOT
For men who treat their tools with pride! The models shown here are made with heavy gauge steel and full length piano hinges that never get out of line. Heavy duty hasps and latches, welded double corners. Bright blue hammerlin boxes, red tote trays. Many models—write for free bulletin. Treat your tools to a Huot!

Model 503—20"—\$9
Model 502—19"—\$7.10
HUOT MFG. CO.
555 N. Wheeler St. St. Paul 4, Minn.



98¢ to \$2.98

HOT RODS for everybody!

All-Plastic Jet and Electric Power Models by Monogram

At Hobby Shops and Other Stores

Hot Rodding is fun with Monogram authentic and popular models. Easy-to-assemble kits. No tools needed. Here are six new models — Dragsters, Rods and a classy Sports Coupe. Exhibition models, jet power models, electric power models. All have rubber tires, the last word in fascinating details and colorful decorative decals.



SPORT COUPE. '32 Ford. Assemble as street coupe or hot rod. Vista dome top. Plated parts. Regular model \$1.98. Motorized model \$2.98.

DEUCE HOT ROD. '32 Ford roadster. The all-time hot rod classic. Big engine. Extra carburetors. Tuned exhausts. Not powered. 98¢



SLINGSHOT DRAGSTER. Scaled from winning drag strip racers. Dummy Chrysler engine and 6 carbs. Power with CO₂ capsule. 98¢

LONG JOHN DRAGSTER. New streamlined model. Brilliant red and silver with overall decal. Jet power model 98¢. Motorized model \$1.98.



BLACK WIDOW. Ford "T" Pick-Up Rod. Removable top and fenders. Chevrolet V-8 engine. Plated parts. Regular model \$1.49. Motorized model \$2.49.

GREEN HORNET. "Show" Rod. Removable top, body and fenders. Converts into "rail job." Plated parts. Regular model (not powered) \$1.49.



Electric motorized kits include motor, nylon drive gears, steel drive shaft and battery holder. Jet power models have receptacle for power cartridge. Some kits with chrome plated parts. Assembly instructions included. Monogram Models, Inc., Chicago 32, Ill.



sive rate. They ruined thousands of acres of sheep range by grazing vegetation down to the bare soil. Then wind took over to create a "living drought." Heroic measures—introduction of rabbit diseases, trapping, poisoning—were required to bring things under control.

Nature herself often provides a set of conditions ideal for a particular species. This happened last year in the irrigated valleys of California and other western states where there was an explosive increase in field mice. Checks indicated populations up to 3000 per acre! The mice ate roots of grain and pasture grasses, then turned to other crops. Officials were on the point of declaring the affected regions disaster areas—then the mice dwindled in numbers. Why? No one knows.

Perhaps the most dramatic example of wild population increases is offered by Norway's famed lemmings—little mouselike rodents. Normally, they live in the high mountains and cause little trouble. But occasionally, population takes a violent upswing, and the rodents are driven to the lowlands in search of food. Driving relentlessly on, swimming streams, eating farms clean, they finally reach the sea. They plunge in and drown. Instinct apparently propels them to their deaths. In Miocene times, land bridges existed over the Baltic

and North Seas. Apparently lemmings are blindly attempting to follow these routes that led their ancestors to lands of plenty.

Nature has a number of weapons to check unruly population increases in any species. Her heavy artillery: Disease and starvation. But there are other means—some extraordinarily complex. Tiny wasps, for example, control many potentially dangerous insect pests by laying eggs in insect grubs. When eggs hatch, the larvae consume the grub. May beetles, which buzz around lights on spring nights, might become serious pests but for a little fly—the *Pyrgota* fly. It darts in, punctures the beetle shell with its oviduct and thrusts an egg inside. When the young hatches, it consumes vital organs of the beetle.

Food scarcity or plenty is illustrated by the clearly defined rabbit-lynx cycle long observed by Canadian trappers. Rabbits are the diet staple of lynxes. When one is plentiful, so is the other. Conversely, their populations decline together.

Every piece of land has a firmly fixed "carrying capacity." Durward L. Allen, Department of the Interior ecologist, asks us to imagine a bus load of passengers set down in the arctic tundra. Within a short time, all would die for lack of food. Precisely the same thing happens with any animal species. Attempts are often made

Only Eclipse Mowers



RIDING MODELS

Make lawn mowing almost fun! The Eclipse Deluxe "Ranger" mows up to 5½ acres a day. It's ruggedly built with auto-type tubular steel frame. Has two forward speeds and reverse. Big canvas "Sun-Brella" is an optional accessory... fits on to tow-bar pin at rear of mower. Try it soon at your Eclipse dealer.



REEL-TYPE

Preferred by many who take special pride in their lawns... Eclipse precision reel-type mowers—18" to 25" models—give a smooth shearing action that's ideal for Bermuda, Zoysia, and St. Augustine, as well as blue grasses.

**SEE THE BIG "E" LINE
AT YOUR DEALERS SOON...**

POPULAR MECHANICS

to stock game birds on unproductive land. Almost always they perish within a few days or weeks.

Protection from enemies is similarly essential. Along this line, Michigan had an unusual experience. The state was once one of the nation's best quail regions. When bird population began to drop, conservationists stepped in. The bobwhite was declared a songbird and further hunting was stopped. Instead of increasing, quail virtually disappeared. The reason soon became apparent. Early this century, Michigan farms were bordered by forests and hedgerows, which provided excellent quail shelter. Gradually, more intensified cropping became the rule and bird shelters were put to plow. Their natural habitat destroyed, the bird population dropped.

Curiously enough, the abundance or lack of food appears to have a marked effect on breeding habits. In times of food scarcity, litters of rodents are smaller and fewer. This appears to carry over even to the bird world. Several years ago, hawk nests were studied during a period when field mice were plentiful. Nine nests produced 22 birds in a season. During a low-mouse year, only two hawklings were hatched in the same nests.

Have all man's nature tinkering had bad results? By no means. As ecological knowl-

edge has grown, scientists have often been able to step in and ward off potentially dangerous situations. Thus, a few winters ago a large number of wild ducks were marooned on the Snake River in Idaho. With the best will in the world, sportsmen proposed a feeding program to keep them alive. An ecologist investigated. He found the ducks infested with parasitic disease. That was why they lacked strength to fly south. A feeding program would have kept them alive and permitted them to pass their disease to healthy ducks the following year—with possibly disastrous results. Better to let them die, the scientist decreed.

While some species have disappeared—largely because of changing land use—others have found new conditions advantageous. Thus, there are far more deer and quail today than when the first settlers stepped ashore in North America. New species have been introduced and have thrived handsomely. The pheasant, brought in from Asia late last century, is an example. Prior to 1905, not more than 500 pheasants had been stocked in the prairie states. Yet they liked their new home and thrive so well that eager hunters were able to take 42 million of these birds in the 1940-50 decade in the Dakotas, Nebraska, Iowa and Minnesota.

(Continued to page 270)

give you MOW-ABILITY*

ROTARIES

You get power to spare with 4-cycle Briggs & Stratton engines on all Eclipse mowers. Your Eclipse dealer will be glad to show you all the new features that make an Eclipse mower your best buy in the long run. New wind-up starter is furnished on W-20 and W-22 Duo-Masters.

GRASS CATCHER (Optional extra)

Collects clippings as they leave discharge chute. Easily attached. Fits all Eclipse walking rotary models.

EASY CUTTING HEIGHT ADJUSTMENT



It's brand new and exclusively Eclipse! A simple twist of one control adjusts all four wheels simultaneously. Select any cutting height between 1 1/8" and 3 1/8"—even while mower is operating.



13 MODELS PRICED FROM \$69.95

MARCH 1960

- *DESIGN AND CONSTRUCTION TO OUTPERFORM
- ALL ORDINARY MOWERS YEAR AFTER YEAR—
- FOR THE LOWEST ANNUAL OPERATING COST

RUGGED AS A RHINO

- Inside and out—from stem to stern—Eclipse mowers are built to "take it." Many Eclipse mowers 20, 30, or even 50 years old are still on the job and cutting efficiently.



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- Eclipse mowers seem to have "9 lives"—just don't die easily. To assure long life, repair parts are available for many years after the expected life of the average mower.



POWERFUL AS A BULL

- Equipped with job-matched 4-cycle engines, Eclipse gives you a bonus of reserve power. You can operate your mower at safer, quieter and more economical half speed.



- THE ECLIPSE LAWN MOWER CO.
- Div. of Buffalo-Eclipse Corporation
- 3014 Railroad St., Prophetstown, Illinois

ECLIPSE



James G. Groendyk of Upper Saddle River, N. J., checks the mighty engine of his 1931 Duesenberg Convertible Roadster

"Quaker State protects the engine of my classic Duesenberg *and my new car too!*" This Duesenberg Model J boasted the most powerful engine of its day. Its huge 420 cu. in. straight 8 was rated at 265 h.p., and it was guaranteed to give 92 miles per hour—in *second gear*. Its condition today—better than new! Smart motorists rely on Quaker State Motor Oil. Refined only from 100% Pure Pennsylvania Grade Crude Oil, the world's finest, Quaker State assures complete, long-lasting protection.

*Available most everywhere
... always ask for
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QUAKER STATE OIL REFINING CORP., OIL CITY, PA:
Member Pennsylvania Grade Crude Oil Association

The same ecological rules that prevail in the animal world are also at work in the plant world. A particular species, finding conditions to its liking, thrives—often at man's cost. The Klamath weed, called St.-John's-wort in Europe, offers a striking example. Klamath is the great destroyer of range land; it chokes out grass and is poisonous to cattle. It virtually ruined 400,000 acres of California range land and blighted additional tens of thousands of acres in other western states. A good case might have been made for accepting the weed as a natural part of the western environment. Department of Agriculture scientists felt differently. They thought they could tilt the ecological scales in man's favor in a novel manner. They set out to find an insect which would eat the weed, since destruction by spraying would have been too expensive. They found what they wanted in Australia—a little beetle. Introduced in 1947, it has cleared the weed from tens of thousands of acres. Ranchers around Fortuna, Calif., were so grateful that they erected a monument to the beetle!

Australia had a similar experience. Thirty million acres of potentially good grazing land were ruined by cactus. To clear it away would have cost an impossible \$2 billion. Australian bug hunters solved the problem by searching the world and finally finding a cactus-hungry moth in Argentina.

Thus, we will continue to tinker with nature—with results sometimes good, sometimes bad. But from now on a better understanding of man's place in his environment is essential. Human existence depends on it. Observes John H. Storer in his book, *The Web of Life*: "The subject of ecology is so vast and complex that no human mind has ever fathomed all its secrets. Many of them can probably never be unraveled, but the basic principles are known. On the functioning of these known principles depends the future of all human life." ★ ★ ★

Titanium "Blasted" Into Shape By Small Explosive Charge

Powdered titanium has been "blasted" into simple metal objects at the U.S. Naval Ordnance Test Station, China Lake, Calif.

The powdered titanium is put in a small die and is rammed into a solid piece by a piston which is driven by a small explosive charge.

The forces appear to be so great that metals can be bonded together by this method that cannot by normal rolling methods. It also appears possible to bond dissimilar materials.

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M-625 (Wt. 70 oz.) Has pull of 125 lbs. on steel block. \$10.00
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M- 47 Hot Pad Magnets, 10 for \$1.00. 50 for \$ 4.87
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Send M.O. or check. We pay postage. Sorry no C.O.D.'s.

MIAMI MAGNET COMPANY, 3240 N. W. 27TH AVE. MIAMI 42, FLORIDA

Tractor with the "Most"

SPEEDEX



9 h.p. B. & S. powered model S-23 shown is today's "MOST" Tractor. Compare with anything on the market at its \$475 price. Two other riding models (4 h.p. & 5 3/4 h.p.) and 3 h.p. walking model

also use complete line of "unit-design" tools. Full year guarantee; sold on 10 day money-back guarantee. Color FOLDER gives complete information and dealer's name. Send 10c for it today.

SPEEDEX TRACTOR COMPANY, 367 No. Freedom St. RAVENNA, OHIO

MARCH 1960

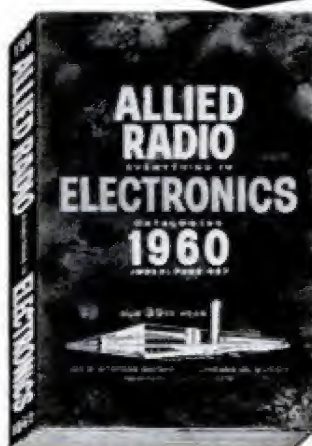


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Owners Report on the Corvair

(Continued from page 128)

More Best-Liked Features

The following quotations describe additional best-liked features in order of frequency of mention, beginning with the fourth-ranking feature, traction on ice and snow:

Amazing how few front-engine advocates you'll meet on an icy hill! →

"Drove more than 200 miles over fresh snow on Highway 40 from Ohio to Maryland. Without chains I climbed some grades that other cars and trucks were unable to climb."—U.S. Navy sailor.

"I do a lot of hunting. Have had the Corvair over all kinds of roads and through fields. Traction is perfect."—West Virginia postal clerk.

We're still looking for the man with that bow and arrow. →

"Parks in spaces that other cars can't get into which is a big time and walking saver to me as space is at a premium where I live and work."—District of Columbia bus operator.

"This car corners very well. I think every car should be built this way. It would be safer on the road today."—North Carolina machinist.

Economy was away down on the best-liked list, at the top of the gripes. →

"If you should turn too sharply or go too fast, errors in steering can easily be corrected and are not so dangerous as on a larger car."—North Carolina insurance woman.

"Much better gas mileage than the 1957 Chevrolet V8. About 8 miles per gallon better and it burns regular instead of premium gas."—South Carolina airman.

"I average 1000 miles per week. The Corvair cruises at 65 miles per hour and apparently isn't under any strain. At 5000 miles the tires show no undue wear. I get 23.5 miles per gallon on long trips."—Florida traveling salesman.

"I like its compactness. It is just the right size car for anybody who is economically minded."—Virginia insurance salesman.

Who sat on the roof? →

"Smallness makes it easy to clean and wax, easy to park."—Wisconsin Air Force member.

"On a recent move from Wisconsin, I transported a wife, four children and a dog plus luggage. We found more usable space than in the two front seats of our former station wagon."—Minnesota hospital executive.

"Unusual pickup for a small car."—Tennessee engineer.

"Wonderful engineering accomplishment. I was wondering which company would wake up to the fact that the engine belongs in the rear. Remember when we used to put bags of sand in the trunk for traction? And in a collision, you do not have to worry about getting a lapful of engine, which can be fatal."—Virginia Navy man.

However, steering is too slow. The car would be more enjoyable, more nimble if the ratio were faster. →

"Air-cooled engine. No worry about water, hoses or anti-freeze."—Nebraska bookkeeper.

"Gets about easily in heavy traffic."—Virginia student.

"I will not buy another car without a gas heater. I deliver newspapers at 4 a.m. and it is very nice to have a warm car in two minutes."—Tennessee newspaper agent.

"No transmission bulge on floor. Seats six comfortably."—Utah ammunition destroyer.

And More Complaints

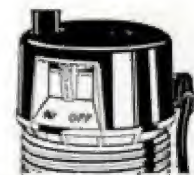
The following quotations describe the things owners don't like about the Corvair. They are listed in order of frequency of mention, beginning with the fourth most frequent:

Average 1930 car was 72 inches high; today it is 56 inches high. Where does it end? In a crick in the back, that's where. →

"It should be made simpler to enter and leave this car. Especially for women. To enter from the sidewalk is like stepping into a gopher hole. When getting out, legs have to

(Continued to page 274)

STANLEY 7/8 HP ROUTER ONLY \$69.95



NEW SAFETY SWITCH
Locks shaft automatically. Change bits fast with just one wrench.



FAST DEPTH ADJUSTMENT
Unique depth gauge sets bit for cuts as fine as .004"—in seconds!



PERFECT VISIBILITY
Spotlight and open base let you see where you are, where you're going.

The power tool that puts new skills in your hands

Of all portable power tools, Stanley's "router with the light" is the one that helps you most in fashioning and finishing fine furniture or wood work of any kind.

Perfectly balanced, the H264 fits and feels right in your hands. You know you can achieve just the right mortise, bead, edge or dado because this is a tool designed to make exacting cuts exactly right. The exclusive Stan-

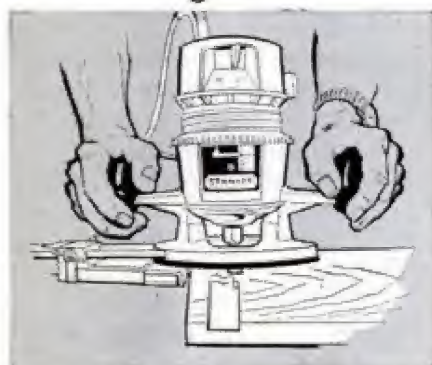
ley spotlight spots the line and lights your way along it. The open base always lets you see what you are doing.

See the Stanley H264 wherever you buy tools. Heft it. You'll want it. For fully illustrated book, "Operation of the Modern Router," enclose 25¢ to Stanley Electric Tools, Division of The Stanley Works, 6203 Myrtle St., New Britain, Conn.

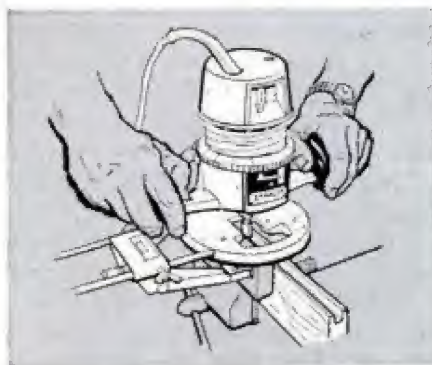
Prices slightly higher in Canada • Canadian office: Hamilton, Ont.

STANLEY

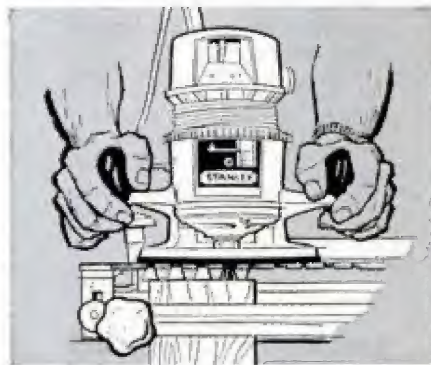
Electric tools built for the professional, priced for everyone



Cutting of dados can be done fast and accurately with the router. You are sure of exact fit, finer craftsmanship when making bookcases, cabinets, dressers, etc.



A Stanley router lets you cut true grooves or slots in the sides, back and front of drawers, boxes, trays, etc. You can even cut a perfect groove on a 3/4-in. narrow edge!



The dovetail joint, very difficult to cut by hand, is done easily and perfectly with the versatile Stanley router and dovetail template—just like the professional!

Word of warning: Don't carry a can of gas under the hood if you plan to run the heater. The right mix of air and gas will explode when heater ignition comes on. Won't hurt you, but sure will inflate the hood. →

If it weren't rounded off, he wouldn't be able to get his feet through the opening. →

Another production fix. Now Corvairs have conventional parking brake handles. →

Dome-light bulbs are imported and when they fail, replacements are as scarce as antifreeze in Wolfsburg. →

Funny about the fan belt. Everybody who looked at it said it wouldn't work. Chevy engineers tested, tested and tested—they insisted it would work. It didn't. But it now has been fixed in production. →

Psychological blunder. With the small 10-gallon tank, you can almost see the needle move down at 70 miles per hour. →

Get rid of overhang and excess length and you automatically make any car stronger, more rigid. Lark found that out. →

be raised to the point where your knees touch your chin."—New York housewife.

"My wife drives the car and when she leaves the seat all the way forward, I cannot get in at all. Once in, there is plenty of room."—Ohio salesman.

"I think it would be almost impossible to vacation with it as there is no storage space. I had to find a short-handled snow shovel to get it into the trunk. There is no room to carry a gas can either. One would not dare drive all night up here where all-night stations are far apart."—North Dakota rural mail carrier.

"Trunk must be closed. If occasionally I have an object to haul which must protrude I cannot do it."—Wisconsin contractor.

"Front seat slopes too much to the back. Should be leveled a little more and raised four inches."—Colorado custodian.

"Don't like rounded-off rear seat."—Rhode Island machine operator.

"Cheap cardboard interior finishing."—Maryland dental school instructor.

"Parking brake trouble. Very soft metal in the key that drops into the ratchet."—Rhode Island inspector.

"Stock of parts is very poor. We had to wait six weeks for a small heater switch through the cold months of October and November. It was finally fixed by taking the switch off a new Corvair which had not been sold yet."—Wisconsin bookkeeper.

"Dome light has burned out three times. Unable to get proper cartridge type bulb."—Vermont engineer.

"Poor dealer service. Dealer claims no training for mechanics. Advises me to expect delays due to new car."—Delaware housewife.

"Headlight dimmer switch is inconveniently located on the floor. One would get tired if driving a long distance at night."—Tennessee nurse.

"Fan belt trouble. Cog belt turned over and was replaced with a smooth V-belt, which works fine."—Ohio millwright.

"Fan belt broke at 1550 miles. For women Chevrolet should provide an extra belt and wrench."—North Carolina occupational therapist.

"At first I thought the price was too high, but after having driven it I can see it's well worth it."—Wisconsin executive.

"Can buy a six-cylinder Chevy just as cheap."—Tennessee owner.

"Would like a Park gear as I sometimes fear the brake might not be enough on a steep hill."—New Hampshire summer theatre sponsor.

"Gas tank too small. Have to stop every 2½ hours for gas."—New Hampshire physician.

"It's a long reach with a bag of groceries in one hand to reach inside and unlock the rear door."—Ohio social worker.

"Doors do not open in same manner. Front and rear inside handles work in different directions."—Virginia homemaker.

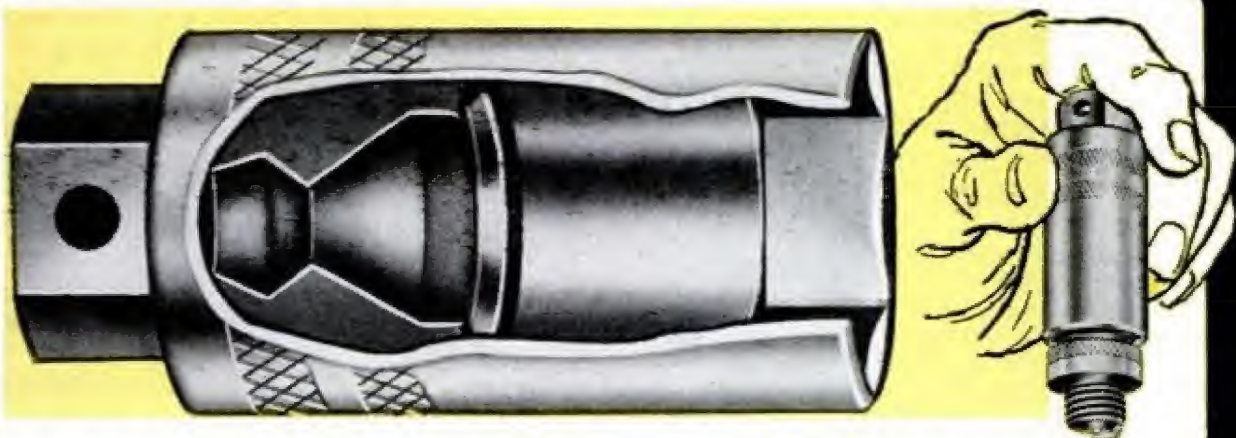
"Angle of windshield picks up much sun glare. Also steams up easily."—Rhode Island photographer.

"Bumpers do not give enough protection against minor parking bumps."—Virginia inspector.

"Back air grille is too low and will get damaged. But I have been in three rear-end accidents already. Damage to my car has just been superficial. I think it is one of the safest and sturdiest cars on the road."—Utah electronics technician.

Here are a few miscellaneous complaints and suggestions,

(Continued to page 276)



PROTO'S SPARK PLUG HOLDING SOCKETS. Revolutionary neoprene insert prevents burned hands, cracked porcelains, damaged electrodes. Available in $\frac{3}{8}$ " (No. 5026HP) and $\frac{1}{2}$ " drive (No. 5326HP). Both sockets fit all standard 14mm plugs in domestic and foreign cars. Turn with fingers, flat wrench, ratchet, torquer. Look for counter display-demonstrator. You'll find over 2,200 quality Proto tools at auto parts, hardware and industrial outlets. Professional performance guaranteed.



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SOLVING CRIMES BY HYPNOSIS

*— a fascinating
feature to watch for*

in the

APRIL POPULAR MECHANICS



Custom Sportsman (CSP-156)

CLEAN LINES — BRIGHT ACTION — SPARKLING BOAT!

Fiber glass is wonderful the Traveler way. And you'll see it as perfection in this 15-ft. deluxe runabout. Smartly flared bow; perfected lapstreak hull gives dry, comfortable ride. Bright colors molded into hull and deck. Matching upholstery features seat back stretch pockets and approved life preserver seat cushions. See it at your nearest Traveler dealer's.

Free: Write for full-color catalog on the exciting 1960 models—both aluminum and fiber glass.

Arkansas Traveler Boats, 2006 E. 14th St., Little Rock, Ark.



Serious fault is the erratic action of front brakes when wet. They are not even reliably capricious. In some rains, even heavy ones, brakes are unaffected; in others, they pull to one side dangerously. →

Miscellaneous comments: Here's a car that is hard to be matter-of-fact about. List all its faults (as this story has) and it sounds very poor indeed. Yet it's far from that. If you like good machinery, well-thought-out design, sure-footed suspension, economy tempered with power, needle-threading steering and excellent road sense, you'll like the Corvair. But if you aren't willing to put up with low seats, hard-to-close rear doors, an unconventional trunk, you won't like it. It's a car you'll either love or detest—there's no so-so about it. As you may have suspected, this writer likes it.

made by a small number of owners but enough so that they are of interest:

"In wet weather brakes become erratic."—Tennessee physician.

"Hooks should be installed in the rear for hanging clothing."—West Virginia professional soldier.

"Speedometer cable needs to be changed. Needle vibrates."—North Carolina Army man.

"Gasoline indicator reads empty when about 3.5 gallons are left."—Ohio mechanical engineer.

"How can I hook up and pull a trailer if I want to?"—Ohio carpenter.

"Rear door handles are placed wrong. Women and children cannot close doors from inside."—North Carolina radio station owner.

"Horn button very hard to get to."—North Carolina textile manager.

"Corvair engine is not built for dusty conditions, but the air cleaner is easily serviced and is quite efficient."—South Dakota pastor.

Finally, here is a summation by a Corvair owner that tells the whole story:

"To rate the Corvair excellent over-all would be stretching it a bit. To rate it average over-all would be an understatement. Many features are excellent such as the full seating capacity, full legroom, simplicity of design with nothing spectacular or unnecessary. Its ease of braking, with no bounce or dive, just a steady deceleration, like closing your fist. I suppose every new car has to have the bugs worked out of it by trial and error, but unless you make mistakes you never know just where you stand anyway."—Virginia civil service clerk. ★ ★ ★

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Sizes from 6 ft. to 12 ft.



CLIPS ON BELT!

YOURS FREE! — A fitted belt holster with each EVANS "White-Tape" that you buy! Metal-reinforced holster provides great on-the-job convenience — clips to the belt, for easy carrying and quick measuring.

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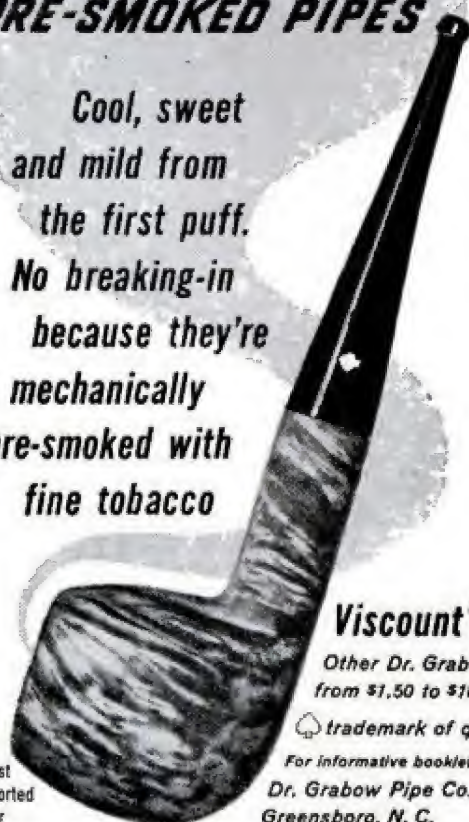
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2902

We're Going to Work Miracles

(Continued from page 101)

Ordinarily oil wells would then be drilled into the shattered area to pump the liquefied tar to the surface where it could be refined into various petroleum products.

An even more difficult and ambitious problem, one that might be called only a dream, is to extract the hydrocarbons that are trapped in the oil shales of Colorado, Utah and Wyoming. An experiment is being considered for performing an explosion in this area. In this case much more heat is required to liberate the oily substance from the shale. The heat of the nuclear explosion will not suffice. Actually the explosion is considered only for the purpose of breaking the shale. Once this is done, one might start an underground fire in the shale. The heat of the fire would then drive out some of the valuable hydrocarbons.

Experience Needed

But this is all speculation; we have had no experience in shattering or heating or modifying an underground petroleum deposit. At best the first attempts will not be perfect. The probability that either project will succeed may not be very high, yet success would increase the world's available supply of oil by billions of barrels. It is worth the venture when the reward can be so great. What we should like to do is to perform exploratory explosions in a really safe manner and observe the results. The results may be surprising and all surprises need not be disappointments.

If producing oil may be called a dream, we might be excused if we call the next possibility a real pipe dream. This has to do with producing heat underground and then mining the heat and changing it to electricity. We can create the heat cheaply—that we know. The question remains whether a pipe or system of pipes can be installed in the hot area cheaply enough and whether the pipes will stand many consecutive explosions, or that we can draw off the heat at an economical cost.

Project Gnome will tell us a great deal about this method of producing electricity. The plan is to explode a 10-kiloton device in a thick bed of natural salt 1200 feet below the surface near Carlsbad, N. Mex. The salt is very dry, hence very little steam will be created that could dissipate the heat. We hope that the blast will melt considerably more than 1000 tons of material, creating a pool of molten salt having a minimum temperature of around 1500 degrees. Air or carbon dioxide would then be bubbled through this reservoir of heat and the re-

(Continued to page 280)

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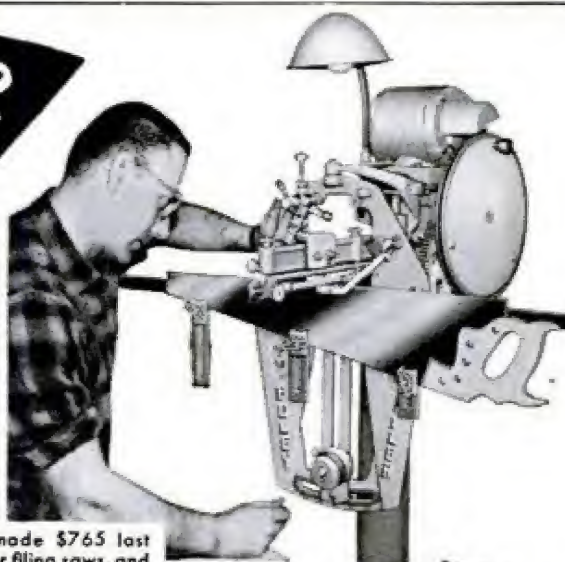
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sulting superheated air or steam would be piped to the surface to operate an ordinary electrical powerplant. Project Gnome is a very small scale experiment; for economic power production thermonuclear devices in the megaton range could be used to create vast underground deposits of heat. When this will become possible and whether it will ever become important, we certainly do not know.

We believe we will be able to produce new things underground that we can later mine. We can make isotopes underground, and some of these isotopes will be valuable. We might be able to produce diamonds, not of gem-stone quality but as a fine powder which has industrial uses.

There is enormous potential in using nuclear energy underground to create the heat and pressure needed to carry out strange chemical reactions that may produce entirely new types of materials never seen on the face of the earth. The problems are: to produce them from materials which are already present in the underground location, to mine them cheaply—for instance, in the form of a fluid—but more than anything else to recognize which are the really interesting materials one can obtain this way.

Water Important

A fluid that is even more important than oil is ordinary water, and it has been proposed that we regulate the flow of water on the surface or underground by means of nuclear explosions. One suggestion is to shatter a formation so that a subsurface flow of water would be trapped in the shattered area, from which it could be pumped. There is a chance that the water would leach out some radioactive products and carry these with it. Our present experience indicates that any leaching would be so slow that the radioactive products would have decayed to a safe state by the time they have moved a significant distance. However, this is one more reason why we must strive to produce clean explosives, and until we have clean explosives, we must proceed with the greatest caution.

Nuclear explosions could be used to produce cheap earth-fill dams, to deflect rivers and to decrease the cost of hydroelectric projects.

There have been suggestions that we could bomb a hurricane out of existence. This seems extremely difficult. The energy in a hurricane is too great. Another proposal has been to use a nuclear explosion as a trigger that would modify climate or weather. The late mathematician John von Neumann suggested that a nuclear explo-

(Continued to page 282)

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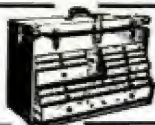


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sion could throw up dust of the right particle size. The particles should be bigger than the wavelength of sunlight so they would shut out the sunshine, but they should be smaller than the heat radiation emitted by the earth. Thus the usual balance between incoming and outgoing radiation would be changed in the region where the explosion has produced dust. In this way, we could govern much bigger energies than that of the explosion itself. There is just a chance that we really could influence weather.

For the time being, we are not planning anything along these lines. Weather modification is mentioned only as an example of the possibilities that might arise in the distant future.

Plowshare is still a very new and untried enterprise. It cannot prosper without two necessary ingredients—careful thought and careful experiment. So far we have tried to give the problems careful thought, but we are woefully short on actual experience. The field is full of new possibilities. It may well be that the main application of nuclear energy will be along lines of which no one has yet thought. ★ ★ ★

Supersonic Waves Detect Cancer Tissue

Russian engineers report that they have developed a machine that is quicker than X rays in detecting changes in human body tissues that give first warnings of cancer and other diseases. The machine shoots supersonic waves into the body and measures the difference in their passage through healthy and abnormal tissues. It's as simple as having an X ray, the engineers say, but without any radiation or other discernible dangers.

Called UZD-4, the apparatus was developed over the last three years by Moisei Gurevich, a radio engineer at the USSR Research Institute for Medical Instruments in Moscow. Gurevich stressed the fact that the device doesn't detect cancer as such, nor does it indicate if the tissue differences are harmful. That decision is left for the doctor.

The machine, about the size of a large refrigerator, can measure changes in human tissue composition down to one percent or less. The UZD-4 has an oval-shaped apparatus that is placed against a section of the patient's body which has been covered by a rubber pad coated with glycerine or water. When the sound waves are sent through the body, their reaction is noted on a small round televisionlike screen. Places as small as one centimeter in width in which tissue is starting to harden or decay can be detected.

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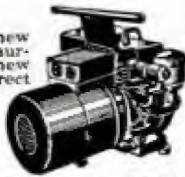
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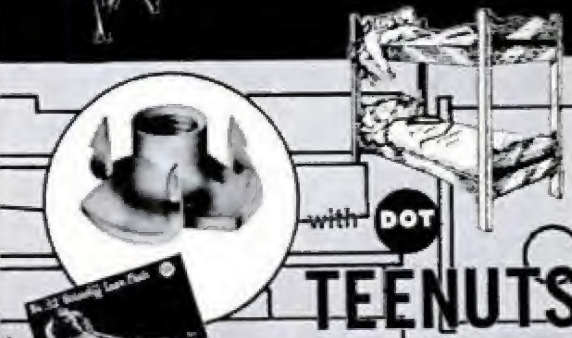
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program sources. It would be frustrating indeed should you want to install an additional signal source, say a tape recorder or TV tuner, at some later date only to find that you don't have enough inputs. With the amplifier you buy you should at least consider the following inputs:

1) Separate inputs for magnetic and ceramic phono cartridges (you may want to change from one to another some time in the future and the two have different amplifier requirements).

2) Radio tuner input—one for each stereo channel.

3) Tape head input. Someday tape players may become as popular as record players are today. Though not essential at this time, this may save the cost of a separate preamplifier later.

4) Microphone input. If you ever want to use your amplifier for public-address purposes, this one comes in very handy.

5) At least one and preferably two high-level auxiliary inputs, for routing the signal from other equipment through your hi-fi system.

Selector Switch. The selector switch of a stereo amplifier connects any desired signal or pair of signals to the input of the amplifier. Usually this switch affects both amplifier channels simultaneously, though in some units separate selector switches are provided for each channel. The former method is far more convenient to operate, though the latter offers some slight increase in versatility.

Mode Switch (sometimes called Function Switch.) This one is used on stereo amplifiers only. Since such amplifiers must handle monophonic as well as stereo signals, the switch sets up the amplifier for either type of operation. Typical positions are: Stereo; Stereo Reverse—which reverses the apparent positions of the two halves of an orchestra; Monophonic A and Monophonic B—which permit playing a monophonic signal source through both amplifier channels simultaneously; Channel A and Channel B only. These last two positions are not included in all stereo amplifiers. They permit playing a monophonic source through only one of the amplifier channels, a function which is of questionable value.

Volume or Level Control. Normally, this control needs no explanation. In stereo, however, there are two types. With some stereo amplifiers the volume of the two channels can be adjusted independently in order to obtain precise balance between the two stereo signals; with others, a single control varies the volume of both channels simultaneously while a separate Balance

(Continued to page 286)

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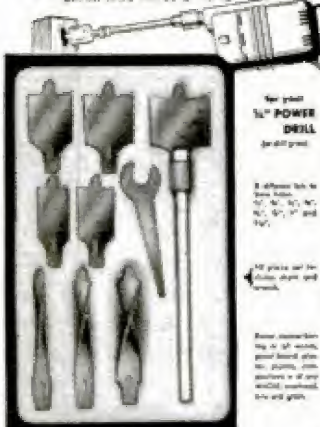
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Control permits compensation for the differences in the individual signals. Both methods are satisfactory though the former is somewhat more flexible while the latter is a bit easier to use.

Tone Controls (Fig. 4B). All hi-fi amplifiers have separate tone controls for both bass and treble frequencies. Some stereo amplifiers have separately adjustable tone controls in each channel while with others the controls affect both channels simultaneously. Here there is a definite advantage in being able to adjust each channel individually. Not only does this permit compensation for differences in loudspeaker characteristics, it also permits equalization of different-quality signals, such as in FM-AM stereo transmissions. The separate controls, therefore are definitely preferred.

Loudness Control. The human ear is a strange device. If you were to listen to a number of single-frequency tones, all played with exactly the same amount of power, they would sound equally loud only if they were played at a very high volume level. At low levels, even if all tones had the same power, the high and low-frequency tones would sound much softer than those in the mid-range. This phenomenon of the ear is illustrated in Fig. 4A.

The curves in this graph represent equal-loudness contours for audio frequencies at various loudness levels. For example, if you were to listen to a 1000-cycle tone played at an intensity of 40 db, a 50-cycle tone would have to be played with a relative intensity of 72 db in order to sound equally loud.

Now if a record were played through an amplifier having a flat frequency response (this would be an ideal amplifier), the reproduction would sound like the original rendition only if played at the same volume level as the original. If the volume were reduced substantially, some of the high and low frequencies would not be heard.

To compensate for this deficiency of the ear, many amplifiers include Loudness Controls which automatically change the amplifier's frequency response to boost high and low frequencies as the volume level is reduced. Some manufacturers contend that such controls are unnecessary since the same purpose can be accomplished with the tone controls. Even if this were true (it isn't, since few tone controls have the required range for adequate compensation) a loudness control would still provide a great convenience. By automatically compensating for the deficiencies of the ear, it greatly simplifies adjustment.

Scratch Filter. Records have a way of becoming worn—noisy, scratchy. Most of this noise is concentrated at the higher audio frequencies and can be eliminated by

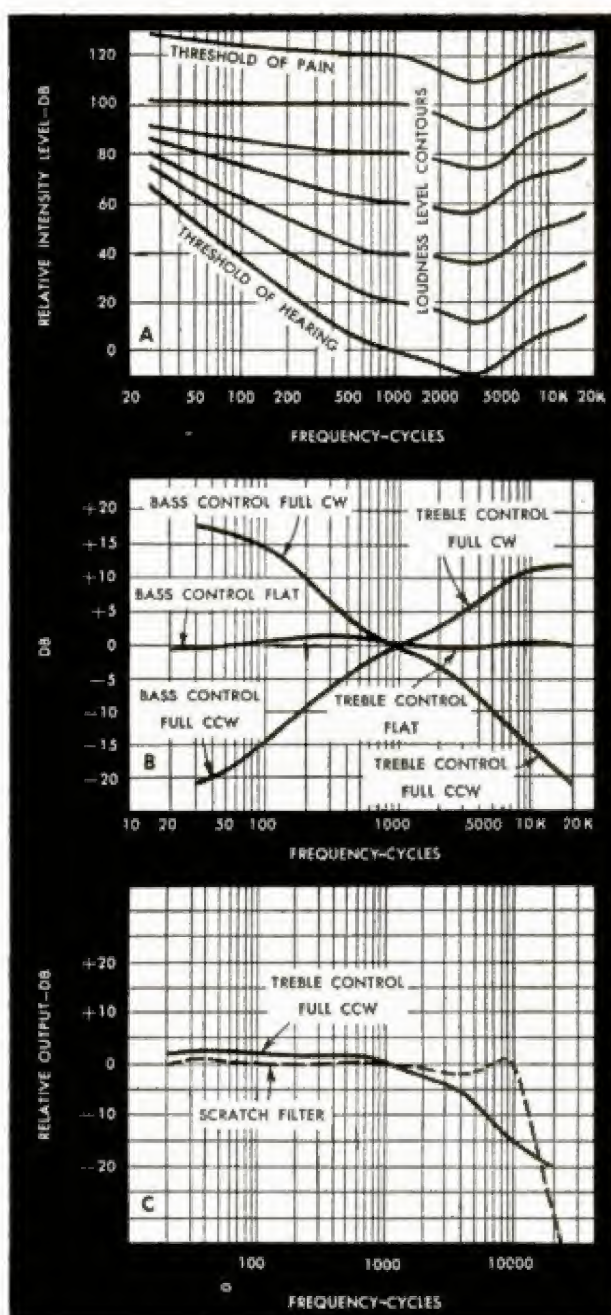


Fig. 4. A. Sound intensity needed for equal loudness of all tones at various basic levels. B. The effect of tone controls in typical amplifier. C. Effect of scratch filter as compared with typical treble control action

reducing the amplifier response in the high-frequency region. This is the function of the scratch filter. True, some of the high-frequency music is lost in the process, but what's left is far more enjoyable.

The treble tone control, if turned down, can accomplish essentially the same function as the scratch filter. The filter, however, has a much sharper cutoff slope, see Fig. 4C, so that less of the high-frequency music is lost in the process.

Rumble Filter. All record players have a certain amount of vibration which is transmitted to the phono cartridge. If moderately severe, this can cause some very unpleasant low-frequency noise whenever a

(Continued to page 288)

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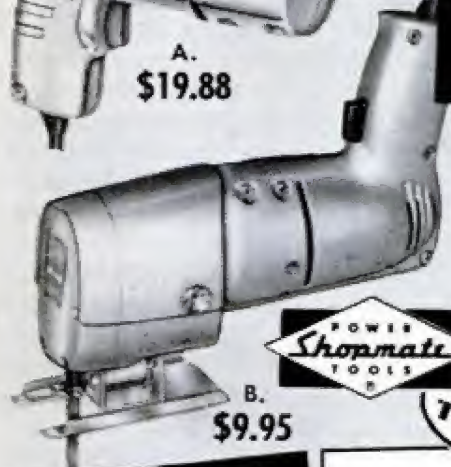
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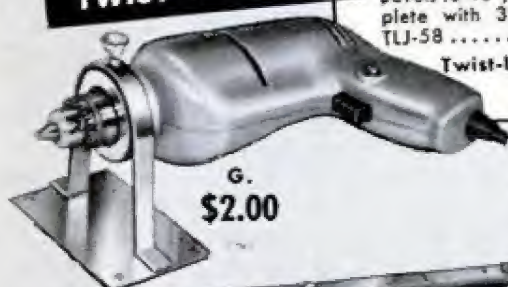


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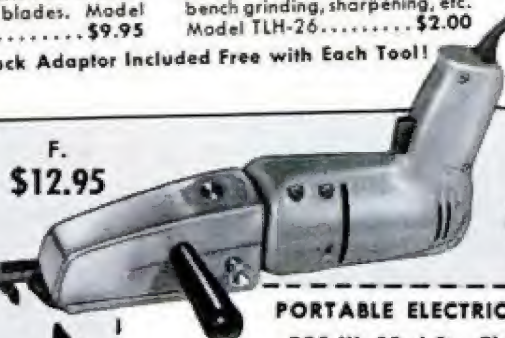
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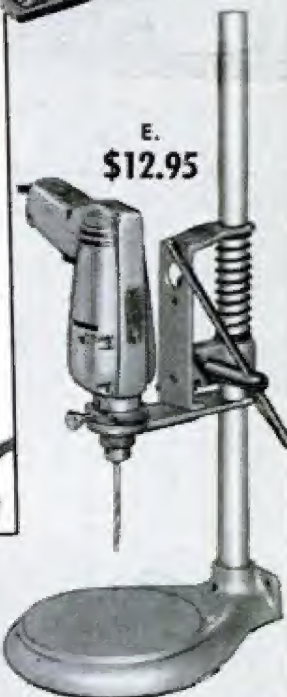
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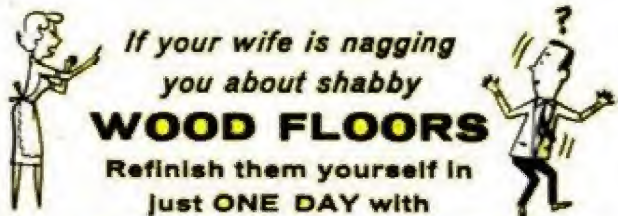
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record is played. The rumble filter does the same thing at the low-frequency end of the audio spectrum as the scratch filter does at the high end. It reduces the amplifier response to this extraneous noise while keeping the loss of the desired music to a minimum.

Phono Equalization. Until some five or six years ago, various recording firms differed in their opinions on how a record should be cut. In reproducing amplifiers, therefore, it became necessary to include a number of equalizing filters so that all records could be properly reproduced.

In recent years, recording firms have standardized the recording process in conformance with RIAA recommendations and the various filters are no longer essential. Still, many amplifier manufacturers continue to incorporate them in their products on the premise that you might have a library of older records. If you do, by all means select an amplifier which offers this feature. If not, this is one feature which need not influence your selection.

Phasing Switch. The two speakers of a stereo system must operate in exactly the same way if optimum stereo quality is desired. If the connections of the speaker wires to one amplifier channel were reversed, the cones of the two speakers would move in opposite directions, causing cancellation of some audio frequencies.

An amplifier which incorporates a speaker phasing switch reduces the job of reversing the connections of improperly hooked up speakers to a mere flick of the switch. Otherwise, the job requires a screwdriver but, in either case, it's not difficult. The main advantage of the switch is in the case of FM-AM stereo broadcasts whose phasing sometimes does not correspond with the standard phasing of stereo records and tapes. In such cases it is far simpler to flick the switch than to repeatedly reverse the speaker connections at the back of the amplifier.

Tape Output Jacks. Most, but not all, amplifiers have two separate output jacks for feeding the signal from any program source to a tape recorder. These are essential if you plan on eventual expansion of your system to include a tape recorder. Preferably, the jacks should be arranged in the circuit so that the amplifier's tone and volume controls do not affect the signal sent to the recorder.

Special Considerations

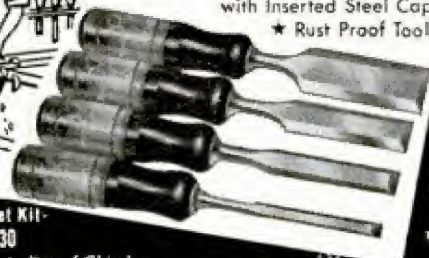
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(Continued to page 290)

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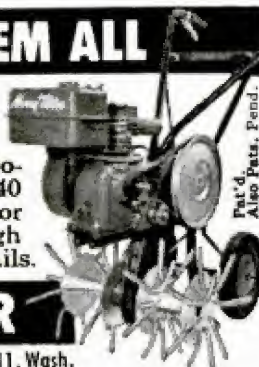
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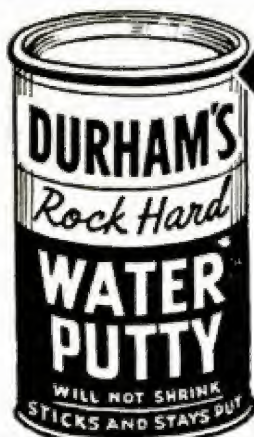
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700 Watt, push button start, 115 v., 60 cye. AC. 2.2 HP. easy starting Briggs eng. No wiring necessary: just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24) Wt. 7.5 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. \$275. **\$143.50**

1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output. **\$199.50**

ELECTRONIC BRAIN Now Available On All Our Plants Up To 100,000 Watts!

Allows plant to saunter along at a thrifty idle till electricity is called for. Then instantly... automatically, plant comes up to full speed with a steady 115 volts of power. When demand stops, the BRAIN returns plant back to that same thrifty idle. Saves gas, doubles engine life! If BRAIN desired, specify & add 3 lb. and \$35 to plant price.



MASTER AIR COMPRESSOR

COMPARE! This is the only compressor built with a **NO RUST** stainless steel tank. Safe up to 500 lbs. (Item 209) High pressure type (4 c.f.m.). Large volume of air for heavy duty spraying, inflating truck & auto tires, greasing, sand blasting, etc. Piston type 2" bore compressor with built-in air filter. Master built with high strength alloys and precision bearings. Tank, 12"x24", 2100 cu. in. cap. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lbs.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. lbs. per sq. in. Beautifully balanced on ball bearing wheels and rubber tires. Don't take chances with used or surplus equipment. Our compressors are factory new and are guaranteed **SAFE**. Low factory prices. 1/2 HP. Model (Cap. 85 lbs.) **\$109.50**

Regularly \$175. (Item 209) **\$129.50**
1/2 HP. heavy duty model, Rep. and **\$129.50**
motor and unloader switch. (Item 209a)

ELECTRIC PUMP

FILL TANKS—DRAIN CELLARS—IRRIGATE \$29.50

Powerful completely enclosed G.E. motor direct connected to a 1" pump, portable, pumps anything, std. thrd., use any hose, foot valve incl. free. 10 day money back guar. **\$29.50**

Wt. 26 lbs. Item C853



HEAVY DUTY D-C ARC WELDER

Use as portable or shop welder. Up to 300 amps, Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to 3/4" plate using 1/4" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heat. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor and triple V belt or flat pulley. You can pay more, but you can't buy a better welder. Wt. 110 lbs. \$400.00 value. **\$119.50**

WELDING KIT. Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder at. **\$10.50**

Send 10c for 100 page Catalog—FREE with order. Prices f.o.b. factory—Send check or M.O.

MASTER MECHANIC MFG. CO., Dept. A-36 Burlington, Wis.

Southern Customers Order from Dept. A-36, Box 65, Sarasota, Florida

even if you've had little or no previous electronic experience. Basic amplifiers—the high-power, separate-chassis variety—are particularly easy. They contain mostly large, easy-to-handle parts and the recommended wiring is uncrowded. Preamplifiers and integrated amplifiers are somewhat more involved and these are usually not recommended as a "first project." Still, if you're meticulous in following instructions, even these will pose no problems.

Printed circuit boards have virtually taken over in kit-built electronic equipment. Of the various amplifiers and preamplifiers tested, only the EICO products still employ point-to-point wiring techniques. Printed-circuit boards can be manufactured at very little extra cost and add little to the price of the kit. They do, however, reduce wiring time and greatly decrease the chances of wiring errors.

But printed circuits also have their disadvantages. Though easier to build originally, they are far more difficult to service than point-to-point wired components. In the event of an inadvertent wiring error or an eventual parts failure, it'll take much more time to track down and replace the offending part—a fact to which most service technicians will attest.

Where to Buy Hi-Fi Components

No matter where you live, a wide selection of hi-fi components is as close to you as your corner mail box. That's because these components are sold through regional and national distributors, who handle most major brands. Even if you don't live in one of the larger cities where the units are on display in dealers' showrooms, you can make your selection from catalogs available free of charge from many distributors. While catalog descriptions are usually sketchy, the same distributors can supply additional manufacturers' literature for any particular unit in which you may be specifically interested.

For component kits you will have to look a bit farther. Though a number of kit manufacturers sell their products through the same distributors and dealers handling factory-assembled units, some of them sell only through their own factory outlets. These publish their own catalogs which you can obtain without cost or obligation. A careful comparison of these products is an interesting, informative and essential part of selecting your personalized high-fidelity equipment. ★ ★ ★

You can obtain a list of major distributors and kit manufacturers by sending a stamped, self-addressed envelope to the Popular Mechanics Electronics Dept.

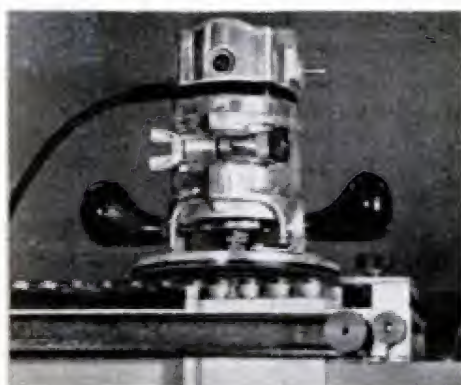
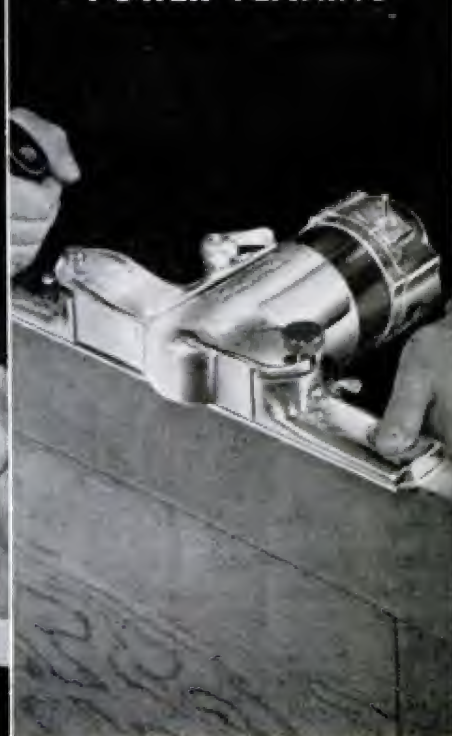
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FURNITURE BUILDING



POWER PLANING



DRAWERS *Dovetail Attachment* makes it easy to build beautifully fitting, professional quality drawers. And those "natural grip" handles give you complete control.



INLAID TABLES, TRAYS You can turn out jobs like these with a professionally crafted look; yet they're duck soup with a B&D Router and inlay strips.

Bet you didn't know B&D Routers are so versatile ...and so easy to use!

A Black & Decker $\frac{3}{4}$ HP Heavy-Duty Router makes it so easy, it makes you an expert! You'll turn out furniture, inlaid tables and trays, decorative what-not shelves, cabinets, paneling, special molding and lots more. You'll make professional cuts—produce professional-looking projects—with amateur ease.

To start with a Router is almost a woodworking shop in itself. And Black & Decker has added *special* features designed to help the beginner. Check the projects and features on this page. Then try a B&D Router in a choice of Routing and Planing Kits, at your dealer's next chance you get. You won't want to put it down!



For 40-page Router manual (a 50c value!) send only 25c in coin to: THE BLACK & DECKER MFG. CO., Dept. D-030, Towson 4, Md.



Black & Decker®

QUALITY POWER TOOLS

"I SAW MYSELF 10 YEARS FROM NOW!"



It happened one payday...

Fred worked on the line next to me. Nice guy. Married. Two children. Been on the same job 10 years.

As we walked away from the pay window together he said, "Funny. Each week I get to feel like I'm letting my family down. You know. Not getting ahead so I can give them the things they need."

His words hit me all of a sudden. I could see myself saying the same thing—10 years from now!

Not only that. I could see the same job. Same thin paycheck. Same worries.

I thought about Fred all day. Then that night

I saw an ad for I.C.S. It told about the job opportunities that open up with I.C.S. training. How people had found new careers and job success.

I mailed the coupon and that was the start. In just a few months my boss discovered I was an I.C.S. student. He was so pleased he decided to move me off the line. A year and two raises later I was made an assistant supervisor.

What about Fred? He's still working on the line. Still hoping for the future.

I told him about I.C.S. But so far he hasn't done anything. I guess some people never will.

How about you?

For Real Job Security—Get an I. C. S. Diploma!

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Without cost or obligation, send me "HOW to SUCCEED" and the opportunity booklet about the field BEFORE which I have marked X (plus sample lesson):

ARCHITECTURE and BUILDING CONSTRUCTION

- ☐ Air Conditioning
- ☐ Architecture
- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
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- ☐ Carpentry and Millwork
- ☐ Carpenter Foreman
- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

ART

- ☐ Commercial Art
- ☐ Magazine Illus.
- ☐ Show Card and Sign Lettering
- ☐ Sketching and Painting

AUTOMOTIVE

- ☐ Automobile
- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Technician

AVIATION

- ☐ Aero-Engineering Technology
- ☐ Aircraft & Engine Mechanic

BUSINESS

- ☐ Accounting
- ☐ Advertising
- ☐ Business Administration
- ☐ Business Management
- ☐ Cost Accounting
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

CHEMICAL

- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ Elements of Nuclear Energy
- ☐ General Chemistry
- ☐ Natural Gas Prod. and Trans.
- ☐ Petroleum Prod. and Engr.
- ☐ Professional Engineer (Chem)
- ☐ Pulp and Paper Making

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- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Sanitary Engineer
- ☐ Structural Engineering
- ☐ Surveying and Mapping

DRAFTING

- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Drafting & Machine Design
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting
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ELECTRICAL

- ☐ Electrical Engineering
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
- ☐ Practical Electrician
- ☐ Practical Lineman
- ☐ Professional Engineer (Elec)

HIGH SCHOOL

- ☐ High School Diploma

- ☐ Good English
- ☐ High School Mathematics
- ☐ High School Science
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LEADERSHIP

- ☐ Industrial Foremanship
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- ☐ Diesel Engines
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- ☐ Industrial Engineering
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- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
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- ☐ Refrigeration and Air Conditioning
- ☐ Tool Design
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- ☐ General Electronics Tech.

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- ☐ Practical Radio-TV Engr'g
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- ☐ Diesel Electrician
- ☐ Diesel Engr. and Fireman
- ☐ Diesel Locomotive

STEAM and DIESEL POWER

- ☐ Combustion Engineering
- ☐ Power Plant Engineer
- ☐ Stationary Diesel Engr.
- ☐ Stationary Fireman

TEXTILE

- ☐ Carding and Spinning
- ☐ Cotton Manufacture
- ☐ Cotton Warming and Weaving
- ☐ Loom Fixing Technician
- ☐ Textile Designing
- ☐ Textile Finishing & Dyeing
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- ☐ Warping and Weaving
- ☐ Worsted Manufacturing

Name _____ Age _____ Home Address _____

City _____ Zone _____ State _____ Working Hours _____ A.M. to P.M. _____

Occupation _____

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NEW, Direct-At-Cost GUARANTEED CONTINUABLE PROTECTION



- Provides EXTRA income while you are accidentally disabled!
- Helps pay those higher-than-ever doctor and hospital bills!
- Helps replace savings or possible loss of income!
- Pays your family as much as \$15,000 if you lose your life, sight or limbs by accident!

Perhaps you believe the hospital care protection you now own is enough to safeguard your family should an accident put you, the family breadwinner, on the shelf.

If so, just consider this:

Hospital costs have actually doubled within the past ten years alone... Has your present coverage kept pace?

Doctor and surgical costs have also gone up... Is your present coverage able to meet today's *increased* cost of medical care?

And what about income protection?... Does your present coverage, if any, take care of what is often the biggest single item of expense in an accident — *income lost because you're no longer on the job?* (The Commercial Travelers loss-of-time benefits are paid direct to you whether your income is affected or not, and regardless of extra expenses caused by an accident.)

MORE PROTECTION Per Dollar

Serving business, professional and technical men, students and all other preferred male risks *direct* and solely on their mutual benefit, this strong old non-profit association literally gives you *protection at cost*. Members' charges are based solely on the full cost of insurance protection, necessary reserves and operating expenses. Pioneer in personal protection since 1883, the Association has paid more than \$125 million benefits to its members and now has resources of more than \$12 million for their future protection. This is world-wide coverage. We are licensed both in New York and Canada.

POLICIES NOW GUARANTEED CONTINUABLE!

Besides being exceptionally economical, broad-coverage accident insurance policies now being written by The Commercial Travelers of Utica offer you the vital *extra* protection of being *guaranteed continuable for life*. This means that now only *you*, the policyholder, can terminate this coverage. And the favorable low rates now prevailing can be changed *only* if there is a general rate adjustment, up or down.

All Kinds of Accidents are Covered except suicide and losses caused by war or while engaged in military service at time of war, insurrection or riot, or as a passenger in military aircraft or a pilot or paid crew member of any aircraft. *No other accident exclusions!* All kinds of civilian passenger air travel covered, as are hobbies, recreational hazards and other avocational risks!

3 PLANS AVAILABLE

Benefits are paid from first day for each accident for as many as 104 weeks of total, or total and partial disability combined, as shown below, whether your income is interrupted or not. *Coverage is continuable for life.*

Choice of Amounts

Total disability, weekly, up to 104 weeks...

\$ 75.00	\$ 50.00	\$ 25.00
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Partial disability, weekly, up to 26 weeks...

\$ 37.50	\$ 25.00	\$ 12.50
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Loss of life, to age 70...

\$ 15,000	\$ 10,000	\$ 5,000
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Loss of life, after age 70...

\$ 3,000	\$ 2,000	\$ 1,000
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Loss of both hands or feet, or one hand and one foot, or sight of both eyes, payable in addition to weekly indemnity...

\$ 15,000	\$ 10,000	\$ 5,000
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Current Quarterly Cost

\$ 10.50	\$ 7.00	\$ 3.50
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No Age Limit for Continuing Accident Coverage, but you must be at least 18 and under age 55 to join.

OTHER LOW-COST BENEFITS GUARANTEED CONTINUABLE

Broad Sickness Insurance *guaranteed continuable* without modification of benefits to age 65, and Surgical and optional Hospital Room benefits *guaranteed continuable for life* are also available to preferred-risk men at modest added cost.

For Employed WOMEN, there's Accident, Sickness and Hospital & Surgical Insurance, and for HOUSEWIVES and other preferred-risk women not necessarily employed there is an excellent Accident Expense policy that is *guaranteed continuable for life*.

SEND CARD, BUT NO MONEY!

Whether you now have partial protection, or none at all, it will pay you to get complete information now on these desirable, low-cost Commercial Travelers guaranteed continuable coverages. So fill out the card right now, while the matter is uppermost in your mind. It may well be the most significant card you ever mailed.

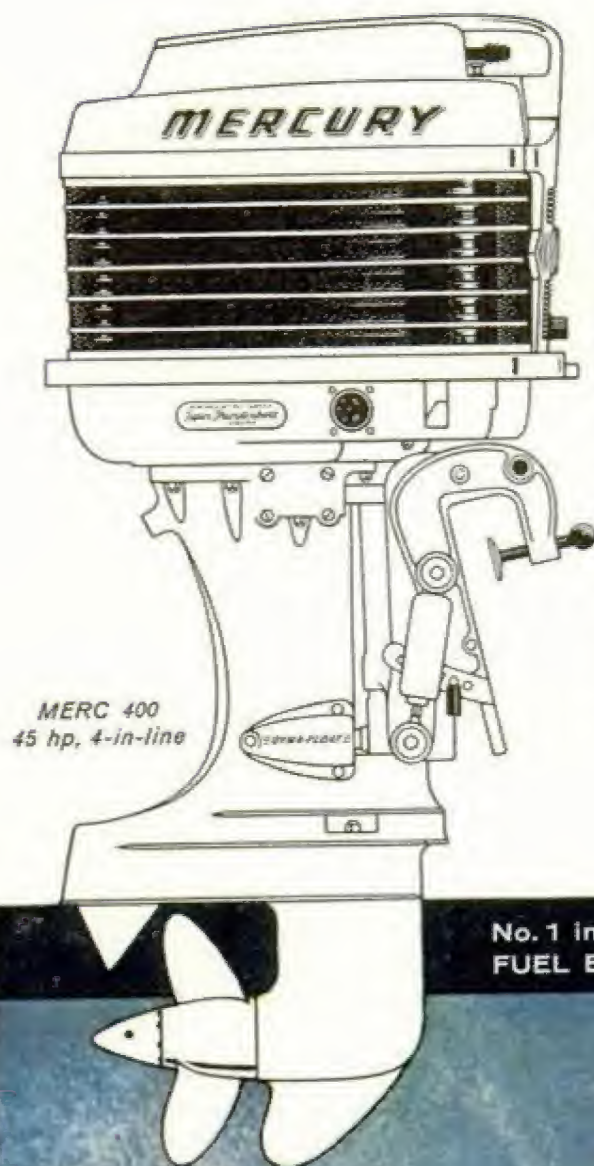
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Reliability is a built-in bonus you get in every Mercury — reliability proved in Mercury's world record 50,000 mile endurance run and Mercury's 107.9 mph world record. Mercurys outrun and outlast all other outboards because Mercurys are safety-engineered to thrive under treatment far rougher than you will meet in normal boating use!

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